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Legal Background

Book 1

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Project Rulison Text of Decision
March 16, 1970

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PROJECT RULISON

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Text of Decision March 16, 1970

CHIEF JUDGE ALFRED A. ARRAJ
United States District Court
Denver, Colorado

With Introductory Remarks By

ROBERT E. MILLER
Manager
Nevada Operations Office
United States Atomic Energy Commission

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UNITED STATES
ATOMIC ENERGY COMMISSION
NEVADA OPERATIONS OFFICE
P. O. BOX 14100
LAS VEGAS, NEVADA 89114

June 1970

The Project Rulison detonation was conducted in Western Colorado on September 10, 1969 as part of a joint government-industry experiment to examine the use of nuclear explosives to stimulate natural gas production under the Atomic Energy Commission's Plowshare Program to develop peaceful uses for nuclear explosives. The project raised concern among certain individuals and groups in Colorado about the safety of the experiment. They sought court injunctions to prevent the detonation and to prevent the post-detonation program calling for flaring (burning) the natural gas produced during production testing, that part of the experiment that would reveal whether the experiment was a success. The U. S. District Court, affirmed on appeals, denied the requests for injunction to prevent the detonation .

This booklet contains the decision by Chief Judge Alfred A. Arraj of the U. S. District Court for the District of Colorado in connection with the requests for injunction to prevent the re-entry into the cavity and the flaring of the gas six months subsequent to the detonation. Of particular importance in the trial were questions raised about the validity of the project, the adequacy of radiation safety standards used by the AEC, and the credibility of the AEC in safety considerations in conducting the detonation and in enforcing these radiation standards.

In the decision, Judge Arraj made several statements that clearly explain the legality and validity of the actions taken by the AEC and the industrial participant in the project, Austral Oil Company, Inc.

The plaintiffs challenged the authority of the AEC to carry out the Project Rulison experiment; the Judge's opinion states:

> "We conclude that the evidence shows that the AEC is following the Congressional mandate and its own rules and regulations, and that the actions and plans of the AEC in prosecution of the conclusory phase of Project Rulison constitute a reasonable exercise of its statutory authority to conduct research in the utilization of atomic energy while providing for the protection of the health and safety of the public."

The plaintiffs in the case also contended that the radiation protection standards now set by the Atomic Energy Commission and the Federal Radiation Council (FRC) were not adequate to protect life, health and safety; the Judge stated:

> "We therefore find that the plaintiffs have failed to establish that the FRC and AEC radiation protection standards are not reasonably adequate to protect life, health and safety. We note that our previous findings in this opinion permitted the avoidance of this issue completely, for the uncontroverted evidence is that the dose to be expected from the Rulison flaring is 0.0025 rem. The FRC and AEC standards are sixty-eight times greater than this dose. If the standard were lowered by a factor of ten as urged by plaintiffs, the revised standard would still be six and eight-tenths times greater than the dose to be expected from the Rulison flaring.
>
> "The proposed flaring of gas from the Rulison Cavity has not been shown to present a danger to life, health or property of the plaintiffs, or any others similarly situated."

The credibility of the AEC was challenged by the plaintiffs who claimed that the defendants detonated the Rulison device at a time when the actual wind direction was not within the sector which AEC plans called for, thereby showing that the AEC cannot be relied upon to follow its own established standards and safety plans.

The Judge determined that the AEC detonated the Rulison device under the proper wind conditions and stated:

> "We find no evidence of an AEC 'credibility gap', and no evidence that the AEC cannot be relied upon to implement its plans for the Rulison flaring within the standards it has established and published."

The AEC is pleased to make this booklet, containing the entire text of Judge Arraj's opinion, available to the public.

Robert E. Miller
Manager
Nevada Operations Office

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

G. WALTER BOWMAN
Clerk

RICHARD L. CROWTHER, WILLARD EAMES, CHARLES MORGAN SMITH, individually and as Parent and Next Friend of JAMES HOPKINS SMITH, III, and JAMES HOPKINS SMITH, III, on behalf of themselves and all persons similarly situated,

Plaintiffs,

v.

DR. GLENN T. SEABORG, Chairman of the Atomic Energy Commission, AUSTRAL OIL COMPANY INCORPORATED, and CER GEONUCLEAR CORPORATION,

Defendants.

Civil Action C-1702

COLORADO OPEN SPACE COORDINATING COUNCIL, on behalf of all those entitled to the protection of their health and safety and the health and safety of those generations yet unborn, from the hazards of ionizing radiation resulting from the distribution of radioactive materials through the permanent biogeochemical cycles of the Biosphere as a result of the defendants conduct of Project Rulison, and on behalf of all those entitled to the full benefit, use and enjoyment of the national natural resource degradation resulting from contamination with radioactive material released as a result of the defendants conduct of Project Rulison, and all others similarly situated,

Plaintiffs,

v.

DR. GLENN T. SEABORG, Chairman of the Atomic Energy Commission, AUSTRAL OIL COMPANY INCORPORATED, and CER GEONUCLEAR CORPORATION,

Defendants.

Civil Action C-1712

MARTIN G. DUMONT, DISTRICT ATTORNEY FOR NINTH JUDICIAL DISTRICT,

Plaintiff,

v.

DR. GLENN T. SEABORG, Chairman of the Atomic Energy Commission, CLAUDE HAYWARD, AUSTRAL OIL COMPANY INCORPORATED, and CER GEONUCLEAR CORPORATION,

Defendants.

Civil Action C-1722

Mr. Robert Bruce Miller, Attorney at Law, 3216 Arapahoe, Suite D, Boulder, Colorado, for Plaintiffs Richard L. Crowther, Willard Eames, Charles Morgan Smith, individually and as Parent and Next Friend of James Hopkins Smith, III, and James Hopkins Smith, III.

Mr. Victor J. Yannacone, Attorney at Law, 39 Baker Street, Patchogue, New York, and Mr. Richard D. Lamm and Mr. Thomas W. Lamm, Attorneys at Law, 555 Petroleum Club Building, Denver, Colorado, for Plaintiff Colorado Open Space Coordinating Council.

Mr. Richard D. Lamm, Special Prosecutor for Plaintiff Martin G. Dumont, District Attorney, Ninth Judicial District.

Mr. James L. Treece, United States Attorney, United States Court House, Denver, Colorado, appearing for Government Defendants.

Mr. Carl Eardley, Attorney at Law, Department of Justice, Washington, D.C., for Defendant Glenn T. Seaborg.

Mr. Thomas Fleming, Chief Counsel, Atomic Energy Commission, Las Vegas, Nevada, and Marcus Rowden, Office of the General Counsel, Atomic Energy Commission, Washington, D.C., for Defendants Atomic Energy Commission and Glenn T. Seaborg.

Mr. James D. Voorhees and Mr. John R. Moran, Attorneys at Law, 818 Patterson Building, Denver, Colorado, and Mr. John M. Berlinger, Attorney at Law, 120 East Flamingo Road, Las Vegas, Nevada, for Defendant CER Geonuclear Corporation.

Mr. James D. Voorhees and Mr. John R. Moran, Attorneys at Law, Denver, Colorado, and Mr. David T. Searls and Mr. John Murchison, Attorneys at Law, First City National Bank Building, Houston, Texas, for Defendant Austral Oil Company Incorporated.

MEMORANDUM OPINION AND ORDER

ARRAJ, Chief Judge

INTRODUCTION

Project Rulison

Project Rulison is a joint experiment sponsored by the Atomic Energy Commission (AEC), the Department of Interior and Austral Oil Company Incorporated, (Austral). The program manager is CER Geonuclear Corporation (CER). Rulison is a part of the Plowshare Program of the AEC, which is designed to develop peaceful use of nuclear explosive technology. The specific purpose of the project is to study the economic and technical feasibility of nuclear stimulation of the low permeability gas bearing Mesaverde sandstone formation in the Rulison Field of Colorado. "Nuclear stimulation" is the detonation of a nuclear device in the formation which will create a cavity and attendant fracture system that will stimulate the production of natural gas from the formation. The Mesaverde formation, because of its low permeability, does not produce natural gas in commercial quantities, although it does contain a significant gas reserve.

The nuclear device was detonated at a depth of 8,431 feet at the Rulison site near Rulison, Colorado, on September 10, 1969. Prior to this detonation all three of the lawsuits dealing with the project had been filed and hearings held at which various plaintiffs sought a preliminary injunction to halt the detonation. This Court denied the preliminary injunctions and the denials were sustained by the Tenth Circuit Court of Appeals, 415 F.2d 437 (10th Cir. 1969) and No. 453-69. All three cases, Civil Actions C-1702, C-1712 and C-1722, are against essentially the same defendants, and this coupled with the identity of the subject matter rendered consolidation of the cases feasible. At the trial of the consolidated cases the plaintiffs sought a permanent injunction against the defendants to prohibit the planned flaring of the gas contained within the cavity created by the nuclear detonation. These plans will be discussed in detail below, but the general purpose of the proposed flaring is to determine the extent of stimulation of production, the dimensions and configuration of the cavity and fracture system, and the technical and economic feasibility of the entire project.

Identity of Parties

The plaintiffs in Civil Action C-1702 are: (1) Charles Morgan Smith, a resident of Colorado who owns property approximately seven miles from the Project Rulison site; (2) James Hopkins Smith, III, the son of the plaintiff Charles Morgan Smith, who occasionally accompanies his father to the property referred to above; (3) Richard L. Crowther, a resident of Colorado who owns real estate approximately thirty miles from Proj-

ect Rulison; and (4) Willard Eames, a resident of Colorado who owns property approximately three and one-half miles from the Project Rulison site.

The defendants in Civil Action C-1702 are: (1) Dr. Glenn T. Seaborg, Chairman of the AEC; (2) Austral Oil Company Incorporated, a Delaware corporation licensed to do business in Colorado; and (3) CER Geonuclear Corporation, a Delaware corporation licensed to do business in Colorado.

The plaintiff in Civil Action C-1712 is the Colorado Open Space Coordinating Council, Inc., (COSCC). COSCC is a nonprofit, public benefit corporation organized and existing under the laws of Colorado. COSCC purports to bring suit as a class action on behalf of all those persons entitled to the protection of their health, and on behalf of all those entitled to the full benefit, use and enjoyment of the natural resources of the State of Colorado.

The defendants in Civil Action C-1712 are: (1) Dr. Seaborg; (2) Austral; and (3) CER.

The plaintiff in Civil Action C-1722 is Martin G. Dumont, District Attorney for the Ninth Judicial District of the State of Colorado, on behalf of the people of the State.

The defendants in Civil Action C-1722 are: (1) Dr. Seaborg, substituted for defendant Atomic Energy Commission by stipulation of October 8, 1969; (2) Austral; (3) CER; and (4) Claude Hayward, the owner of the property on which the Rulison detonation occurred.

ISSUES PRESENTED

The parties were unable to agree upon the wording of the factual issues in the submitted pretrial order. Our review of the evidence presented at trial, the numerous pleadings, and the briefs of the parties filed leads to the conclusion that the following outlined issues of fact and law satisfactorily delineate the areas of contention among the parties. These issues as set out will govern the order of disposition of the three suits in this opinion.

Issues of Law

Because the defendants reserved certain issues relating to the jurisdiction of the Court, these will be disposed of first. The first four issues of law may be considered the jurisdictional issues presented.

1. Do the plaintiffs have standing to sue?

2. Is there a justiciable controversy entitling plaintiffs to declaratory relief?

3. Are the plaintiffs' actions unconsented suits against the United States?

4. Are the plaintiffs seeking review of and an injunction against discretionary acts of the AEC which are not subject to judicial review?

5. Is the AEC following its Congressional mandate and its own rules and regulations in that the actions and plans for protecting health and minimizing danger to life and property are a reasonable exercise of its statutory authority?

6. Are the plaintiffs entitled to an order directing the AEC to answer all questions and to turn over to the plaintiffs all information regarding Project Rulison?

Issues of Fact

The ultimate issue of fact presented by these cases is whether the proposed flaring of gas from the Rulison cavity will endanger life, health and property of the plaintiffs or any others similarly situated, in contravention of the mandate of the Atomic Energy Act. In determining this issue, five subsidiary issues have been raised by the parties and must be disposed of. These are:

1. Do the Rulison plans make reasonably adequate provision for the protection of the health and safety of human, plant and animal life?

2. Are these plans for flaring within the radiation protection standards of the AEC and the Federal Radiation Council (FRC)?

3. Are the defendants prepared and equipped to actually implement the plans for flaring, thus insuring the protection of health and safety?

4. Are there safe economical alternatives to the proposed flaring as a means of determining the effectiveness of the Rulison detonation?

5. Are the FRC and AEC radiation protection standards themselves reasonably adequate to protect life, health and property?

ISSUES OF LAW

1. Standing

Contrary to the assertion of defendant Seaborg in his brief filed August 25, 1969 that Flast v. Cohen, 392 U.S. 83 (1968) is not pertinent to the issues presented by the complaint in this case, the Court believes that *Flast* is more pertinent than Frothingham v. Mellon, 262 U.S. 447 (1923) (relied upon by the defendant). *Flast* should be the starting point of an analysis of the issue of standing. Although both *Flast* and *Frothingham* deal with the specific problem of a taxpayer's standing to challenge federal spending, *Flast* is the most recent comprehensive discussion by the Supreme Court of the general problem of standing.

The *Frothingham* line of cases holds that a plaintiff must allege that he suffers a direct injury to some legally protected interest in order to have standing. The defendants argue that the plaintiffs have failed to satisfy the standing requirement because their claims are predicated upon their residency in Colorado alone. The plaintiffs' status as citizens subjects them to the hazards complained of, but defendants contend that because they are in no different position from other citizens who may be subjected to the pollution claimed, they have no standing to sue. The essence of the argument is that the plaintiffs fail to assert substantial injury to their own legally protected interest.

A clarification of the concept of standing is found in the *Flast* opinion prior to the discussion of the specific problem of taxpayer standing. Then Chief Justice Warren stated that the "case" or "controversy" requirement of Article III embodies two limitations on the federal judiciary. One is the requirement of an adversary context before the courts will act and the other is the separation of powers among the three coordinate branches of the federal government. He noted that "justiciability" is the term of art utilized to express this dual limitation and that there are various grounds on which questions have been held not to be justiciable in the federal courts. Standing to sue is one of these grounds.

The *Flast* analysis of standing reveals that the doctrine primarily implements the requirement of an adversary context for the operation of the federal judiciary in the resolution of a dispute. In order to insure the adversary context, a determination of standing initially focuses on the party rather than on the issues presented. Thus, if the party alleges a personal stake in the outcome of the controversy which will insure sufficient adverseness to adequately present the issues, resolution of the dispute will not be impeded because the case is hypothetical or an abstraction. If the personal interest is found to be sufficient, the next step is to look to the substantive issue presented to determine whether a logical nexus exists between the status asserted and the claim. 393 U.S. at 102.

This nexus appears to us to be the connection between the official action challenged and a legally protected interest required in Jenkins v. McKeithen, 395 U.S. 411 (1969), quoted in defendant Seaborg's brief. In other words, we believe that the standing doctrine requires that these plaintiffs first show a satisfactory interest entitled to legal protection and then show that this particular interest is in some way threatened with sufficient logical directness by the action of defendants to insure that there will in fact be presented to the Court a concrete controversy by adverse interests.

Under this test, it is clear that all of the plaintiffs in Civil Action C-1702 have standing to challenge the action of defendant Seaborg as Chairman of the AEC. Charles Morgan Smith, Crowther and Eames have alleged the ownership of property in the proximity of the Project Rulison site, and each has alleged occasional residence on his property. It is alleged that James Hopkins Smith accompanies his father to the property owned by the elder Smith. These allegations have not been contradicted by defendant Seaborg nor any other defendants. These plaintiffs allege that the Project and the planned flaring of gas will add a sufficient amount of radioactive particles to the atmosphere to create a direct threat to their health, welfare and safety.

These allegations constitute a substantial assertion of a personal stake in the controversy. Plaintiffs assert that they are so situated that the contemplated action of defendants in flaring presents a threat to their health and safety. We need cite

no authority for the proposition that the law protects the interest of persons in their health and safety. We also think that the logical connection between the "status" of plaintiffs as property owners, and occasional residents in the proximity of the Rulison site, and the "threat" to their health and safety affords a sufficient basis for an actual controversy.

Any distinction between the standing of the plaintiffs in C-1702 and the plaintiff in C-1712 must be based upon the fact that the latter, COSCC, is a public benefit corporation bringing a class action on behalf of all persons entitled to the protection of their health and the use and enjoyment of the natural resources of Colorado. We find no significant problem presented by the fact that plaintiff COSCC is a corporate entity seeking to assert the interests of its incorporators and the public for whose benefit it was formed. In the specific area of civil rights, the Supreme Court has recognized the standing of the N.A.A.C.P., to assert on behalf of its members their legally protected rights. N.A.A.C.P. v. Button, 371 U.S. 415 (1963); N.A.A.C.P. v. Alabama, 357 U.S. 449, 459 (1958). Other cases have likewise held in several areas that responsible and representative groups have standing to assert the public interest. Scenic Hudson Preservation Conf. v. Federal Power Commission, 354 F.2d 608, 614 (2d Cir. 1965), *cert. denied,* 384 U.S. 941 (1966); Office of Communications of the United Church of Christ v. Federal Communications Commission, 359 F.2d 994, 1005 (D.C. Cir. 1966); Nashville I-40 Steering Committee v. Ellington, 387 F.2d 179 (6th Cir. 1967), *cert. denied,* 390 U.S. 921 (1968).

Furthermore, there is another rationale available for sustaining the assertion of standing of the plaintiffs in both C-1702 and C-1712. The Administrative Procedure Act (APA) provides for judicial review of agency action. The statutory provision for the right of review is 5 U.S.C.A. § 702:

> A person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute, is entitled to judicial review thereof.

In determining whether the APA does provide for judicial review of Project Rulison at the instance of these plaintiffs, several questions must be answered. First, is this a suit against Dr. Seaborg, or is it in fact one against an agency of the federal government, the AEC? Second, if this is a suit against the AEC, does 5 U.S.C.A. § 702 apply to the AEC under the Atomic Energy Act? Third, if in fact § 702 does apply to the AEC, is the challenged project "agency action"? Fourth, are the plaintiffs in Civil Actions C-1702 and C-1712 persons "adversely affected" or "aggrieved"? Fifth, are the plaintiffs persons adversely affected or aggrieved within the meaning of a relevant statute?

The initial question of whether the suit filed against Dr. Seaborg, Chairman of the Atomic Energy Commission, is one against Dr. Seaborg, the AEC, or the United States is one of the most troublesome presented by the case. The answer to this question goes not only to whether the APA is applicable, but also goes to the question of sovereign immunity. Ignoring for the present time the issue of immunity, it is helpful to consider why the action is so captioned. Plaintiffs claim that Dr. Seaborg, in his official capacity as Chairman of the AEC, is operating beyond the limits of his statutory authority. They seek to enjoin *him* from so acting. The AEC as such is not acting, but rather its executive officer is acting through his subordinates. In order to effectively terminate this alleged action beyond the scope of authority, the judicial action sought must be directed against the acting party.

There are numerous cases dealing with the issue of sovereign immunity that hold that a suit against a public officer is in fact a suit against the government if the relief sought will operate against the government, *e.g.*, Larson v. Domestic & Foreign Corporation, 337 U.S. 682, 687 (1949). Thus, a nebulous characterization has often been utilized to denominate one action to be against the officer, another against the sovereign. Of course, the characterization depends upon the factual setting of the case, and in many, if not most, the distinction is clear. In a case such as that presented here, however, the clarity is diminished by conceptual problems. Here the plantiffs seek to enjoin Glenn Seaborg from acting in his capacity as Chairman of the AEC. The action they wish to enjoin is the culmination of activity by the agency he directs, the AEC, over a period

of several years in the planning and execution of Project Rulison. The reality is that this is the action of the agency, in common language, which plaintiffs would have this Court stop. The further reality is that this agency of the federal government is acting for that government.

However, the problem of *who* is sued apparently has not troubled the Supreme Court in the two most recent and most significant cases dealing with the review provisions of the APA. Neither Abbott Laboratories v. Gardner, 387 U.S. 136 (1967), nor Rusk v. Cort, 369 U.S. 367 (1962), concerned themselves with the question we have here posed. Both held that the review provisions of the APA were applicable in suits which denominated the agency head as party defendant. Therefore, we find that with respect to the applicability of the APA, it is unnecessary to fully answer the first question, since the answer seems to be that this is a suit against all three entities. We also find that the APA is applicable to suits which denominate Glenn Seaborg as Chairman of the AEC, the party defendant, if all other conditions precedent are satisfied.

In determining whether 5 U.S.C.A. § 702 applies to the AEC under the Atomic Energy Act, the starting point for analysis is 5 U.S.C.A. § 559. Section 559 states that the judicial review provisions of the APA cannot be superseded or modified by subsequent legislation except to the extent that such subsequent legislation does so expressly. The Atomic Energy Act does not expressly supersede the APA, but rather makes it expressly applicable to all AEC "agency action", and expressly modifies the APA with two provisos. 42 U.S.C.A. § 2231 states that the APA is applicable to all AEC "agency action", with the proviso that in actions involving restricted data or defense information the AEC shall provide for procedures which parallel those of the APA, in order to effectively safeguard or prevent disclosure. The other proviso is 42 U.S.C.A. § 2239 which expressly modifies the provisions of the APA with respect to procedures for the licensing of production and utilization facilities, procedures for dealing with licensees, and procedures for dealing with patents under the Act. Review of proceedings under § 2239 is by a United States Court of Appeals pursuant to 28 U.S.C.A. § 2342.

42 U.S.C.A. § 2231 provides that the term "agency action" for the purposes of review of the AEC shall have the meaning specified in the APA. Thus, having answered the second question posed in the affirmative, finding that the APA does apply to the AEC, we must determine if the action challenged is "agency action" within the APA. The statutory definition is found in 5 U.S.C.A. § 551(13):

> "agency action" includes the whole or a part of an agency rule, order, license, sanction, relief, or the equivalent or denial thereof, or failure to act.

Definition of the terms "rule", "order", "license", "sanction" and "relief" are also found in § 551. None of these forms of "agency action" except "order" has application to this case. § 551(6) states:

> "order" means the whole or a part of a final disposition, whether affirmative, negative, injunctive, or declaratory in form, of an agency in a matter other than rule making but including licensing;

Our research has indicated no case law directly interpreting these APA definitions. In the absence of such case law, we must make the initial determination of whether the activities of the defendants challenged here constitute "agency action" within the terms of the statute. This determination is probably the key one in disposing of standing under the APA.

The planning and execution of the various steps in Project Rulison have been carried out either directly by the employees of the AEC or under the supervision and control of the employees of the AEC. The affidavit of October 14, 1969 of Mr. John S. Kelly, Director of the Division of Peaceful Nuclear Explosives, states that his Division has the responsibility for

> developing and administering research, development and engineering programs and policies for utilizing nuclear explosives for peaceful purposes (Plowshare Program); approving initiation and implementation of specific projects under the Plowshare Program; giving program direction to Atomic Energy Commission laboratories and operations offices with respect to the

Plowshare Program; and assuring in carrying out the above functions and responsibilities that adequate provision is made for the health and safety of Government and contractor personnel and of the general public. Project Rulison, which is part of the Plowshare Program, falls within the above responsibility.

His affidavit contains further statements indicating that the flaring of the gas will be under the control of the Nevada Operations Office of the AEC, and that it will be within the radiation health standards of the AEC. Also, the testimony of Mr. Robert H. Thalgott establishes that he, as an AEC employee and Assistant Manager for Operations of the Nevada Operations Office of the AEC, is responsible for all nuclear safety of Project Rulison. Further evidence of the AEC role in Project Rulison is found in the numerous AEC publications now a part of this record, which need not be here detailed.

The Rulison activities of defendants Austral and CER also are under the direction and control of the AEC.

We thus conclude that all decisions involved in the Rulison Project relative to the safety of the flaring of the gas from the chimney are those of the AEC. We further determine that the activity of the AEC in the making of decisions and execution of the plans for Rulison is an agency of "order" or the equivalent thereof, since it constitutes a "final disposition . . . of an agency in a matter other than rule making but including licensing . . ." Thus, what plaintiffs seek to enjoin is "agency action" within the meaning of the APA and Atomic Energy Act.

We find no problem in holding that plaintiffs in Civil Action C-1702 are persons "adversely affected" or "aggrieved" within the meaning of 5 U.S.C.A. § 702. As previously noted, they have alleged that they are property owners and occasional residents of the area in proximity to the Rulison site. Thus, if in fact the AEC does violate the statutory standards and permits a release that creates a radiological health hazard, they will be adversely affected. The adverse effect will be the allegedly irreparable injury to their health from the agency action.

In attempting to answer the fourth question posed with respect to the plaintiff in Civil Action C-1712, the answer to the fifth question is inextricably intertwined in the case law. In determining that COSCC has standing under the principles of *Flast,* cases were cited holding that responsible and representative groups have standing to assert the public interest. These cases were all against administrative agencies and are relevant to standing under the APA.

Scenic Hudson Preservation Conf. v. Federal Power Commission, *supra,* is the initial decision of significance holding that organizations and others, who by their conduct exhibit a special interest in areas which an agency is directed by statute to take into consideration, are "aggrieved" parties when the agency fails to consider such matters. The Court there held that the Scenic Hudson Preservation Conference was such an organization, was "aggrieved" by the failure of the Federal Power Commission to consider conservation values as directed by the Federal Power Act in licensing a dam site, and had standing to seek judicial review of the FPC decision.

Similarly, Office of Communications of the United Church of Christ v. Federal Communications Commission, *supra,* held that a representative of the listening public is a person "affected" or "aggrieved" within the Federal Communications Act. Thus, such organization has standing to intervene in a license renewal proceeding. Norwalk CORE v. Norwalk Redevelopment Agency, 395 F. 2d 920, 933 (2d Cir. 1968), dealt with a suit by the Norwalk, Connecticut Chapter of the Congress of Racial Equality, two tenant associations and eight individuals representing low-income Negro and Puerto Ricans displaced by an urban renewal project against the project. Plaintiffs claimed the project did not attempt to assure relocation for Negro and Puerto Rican displacees to the same extent as white displacees, thus violating statutory provision for relocation. One of the holdings of the Court was that the standing of a person depends upon whether they are adversely affected or aggrieved, and this in turn depends upon whether the Congressional purpose in enacting the statute was their protection.

Finally, Road Review League, Town of Bedford v. Boyd, 270 F. Supp. 650, 661 (S.D.N.Y. 1967), an action challenging the determination of the Federal Highway Administrator of a pro-

posed highway route, held, in discussing *Scenic Hudson*, that "aggrieved" has the same meaning under the APA as under the Federal Power Act. Thus, the Court found that local civic organizations and conservation groups are "aggrieved" by agency action which has disregarded their interests, and that they have standing to obtain judicial review under the APA.

We therefore find that COSCC, as a public benefit corporation asserting the interests of all those persons entitled to the protection of their health and all those persons entitled to the full benefit, use and enjoyment of the natural resources of the State of Colorado, is adversely affected or aggrieved, if in fact the AEC is obligated by the Atomic Energy Act to consider the interests asserted by COSCC in its representative capacity.

The final determination in analyzing standing under the APA is whether these plaintiffs are adversely affected or aggrieved "within the meaning of the relevant statute", the Atomic Energy Act. If the Act directs the AEC to consider the health and welfare of the plaintiffs, then they will be, in our opinion, within the meaning of the relevant statute. If it was the intent of Congress in passing the Act to protect the health of the class of which plaintiffs are members, then when they allege disregard of that interest, they are persons allegedly aggrieved or adversely affected within the meaning of the statute and have standing to sue. *See* The Congressional Intent To Protect Test: A Judicial Lowering of the Standing Barrier, 41 U. Colo. L. Rev. 96 (1969).

The following quotes from the Atomic Energy Act, we believe, conclusively show that the AEC is charged by Congress with the duty of considering the interests asserted by plaintiffs in C-1702 and C-1712.

42 U.S.C.A. § 2012

Congressional Findings

(d) The processing and utilization of source, byproduct, and special nuclear material must be regulated in the national interest and in order to provide for the common defense and security and *to protect the health and safety of the public.*

(e) Source and special nuclear material, production facilities, and utilization facilities are affected with the public interest, and regulation by the United States of the production and utilization of atomic energy and of facilities used in connection therewith is necessary in the national interest to assure the common defense and security and *to protect the health and safety of the public.*

(i) *In order to protect the public* and to encourage the development of the atomic energy industry, in the interest of the general welfare and of the common defense and security, the United States may make funds available for a portion of the damages suffered by the public from nuclear incidents, and may limit the liability of those persons liable for such losses.

42 U.S.C.A. § 2013

Purpose of Chapter

It is the purpose of this chapter to effectuate the policies set forth above by providing for—

(d) a program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes *to the maximum extent consistent with* the common defense and security and with *the health and safety of the public;*

42 U.S.C.A. § 2051

Research assistance; fields covered; *conditions*

(a) The Commission *is directed* to exercise its powers in such manner as to insure the continued conduct of research and development and training activities in the fields specified below . . .

(4) utilization of special nuclear material, atomic energy, and radioactive material and processes entailed in the utilization or production of atomic energy or such material for all other purposes, including industrial uses, the generation of usable energy, and the demonstration of the practical value of utilization or production facilities for industrial or commercial purposes;

(d) The arrangements made pursuant to this section *shall contain* such provisions (1) *to protect health,* (2) *to minimize danger to life* or property, and (3) to require the reporting and to permit the inspection of work performed thereunder, as the Commission may determine.

(Emphasis added in all quoted provisions.)

We thus conclude that the interests asserted by the individual parties plaintiff in C-1702 and by the institutional party plaintiff in C-1712 are personal interests protected by the language of the relevant statute. We conclude that these parties have standing under the APA and the Atomic Energy Act to challenge the actions of the AEC which allegedly disregard the Congressional directive to protect the public health and safety.

We would note that in fact it is immaterial in this particular case whether the plaintiffs in C-1702 and C-1712 assert standing in the general equitable jurisdiction of the Court or under the APA. We also are of the opinion that our interpretation of the APA's applicability to the alleged disregard by the AEC of statutory standards is dictated by the language of the Supreme Court in *Abbott Laboratories*:

> The Administrative Procedure Act provides specifically not only for review of "[a]gency action made reviewable by statute" but also for review of "final agency action for which there is no other adequate remedy in a court," 5 U.S.C. § 704. The legislative material elucidating that seminal act manifests a congressional intention that it cover a broad spectrum of administrative actions, and this Court has echoed that theme by noting that the Administrative Procedure Act's "generous review provisions" must be given a "hospitable" interpretation. Again in *Rusk* v. *Cort, supra,* at 379-380, the Court held that only upon a showing of "clear and convincing evidence" of a contrary legislative intent should the courts restrict access to judicial review. (citations and footnotes omitted). 387 U.S. 140-41.

Accord, Association of Data Processing Service Organizations, Inc., v. Camp. 38 L.W. 4193 (March 3, 1970); Barlow v. Collins, 38 L.W. 4195 (March 3, 1970).

In determining whether plaintiff Martin Dumont in Civil Action C-1722 has standing to sue, the discussion above is pertinent. He must assert a personal interest entitled to legal protection and show that the interest is threatened with logical directness by the action of defendants. If he cannot do this, since he does not claim standing under the APA, he does not have standing.

Plaintiff Dumont's complaint alleges three counts, which for the sake of brevity we will summarize as embodying a claim of trespass, a claim that the AEC and other defendants have not stayed within the authority granted by the Atomic Energy Act, and a claim that the defendants will create a nuisance. By stipulation of the parties in C-1722, the rulings and findings of the Court at the hearing for a preliminary injunction in C-1702 and C-1712 were made a part of C-1722. The rulings at that hearing are dispositive of Dumont's claim on both trespass and nuisance. The ruling at page 3 of the Rulings is that the Rulison activity is specifically authorized by the federal government and therefore cannot constitute a nuisance in a legal sense. This disposes of the nuisance claim. With respect to the trespass claim, it is in essence one which, after the detonation, is moot. Any actual damage to property caused by the blast is past and cannot be enjoined. Also, since such damage to property in the plaintiff's judicial district is compensable, there is an adequate remedy at law, and thus the claim does not give plaintiff standing in this Court to seek an injunction.

Finally, plaintiff's allegation that defendants are exceeding the statutory guidelines does not contain sufficient allegations of his own personal stake in the controversy to establish his standing. He alleges nothing more than his position as district attorney. He does not allege that he owns property in proximity to the Rulison site, nor does he allege an interest in conservation or the protection of the public health (other than as criminal prosecutor) as does COSCC. Thus, Dumont has failed to establish that he is a party whose interest is adequate to present a justiciable controversy sufficient to provide the adversary setting necessary for the operation of the judicial machinery. Since Dumont has failed to establish his standing, the Court cannot permit a party to appear and prosecute as district attorney alone, riding, as it were, on the coattails of the plaintiffs who have established their standing. Therefore, Civil Action C-1722 must be dismissed for lack of standing.

2. Justiciable Controversy

The discussion in *Flast, supra,* of the concept of justiciability is dispositive of the assertion of defendants that there exists no justiciable controversy. "Justiciability" embodies two limitations, one the necessity of an adversary context, and the other the concept of separation of powers among coordinate branches of the federal government. Our discussion of standing under the *Flast* rationale or under the APA establishes to our satisfaction that from the perspective of adverseness, a justiciable controversy is presented.

With respect to the concept of separation of powers, we believe there can be little contention that the governmental philosophy embodied in the Constitution ties separation of powers into a union with the concept of checks and balances which cannot be severed. Thus, concomitant with separation of powers is judicial review. Marbury v. Madison, 1 Cranch 137 (1803).

Defendants' assertion at the initial stages of the proceedings that the detonation was authorized by Congress and the President is presumably the basis of the reservation of the issue of justiciability, if such issue is reserved, to claim that a political question is presented. However, at the trial issues were more focused, and the principal question presented was the flaring, and whether such action was planned with due regard to public health and safety. This question as presented was framed in the context of an allegation that the executive officer of a federal agency was acting in excess of the authority granted to him by statute. Such a question is not a political question. It has long been a part of equity jurisdiction and has been specifically assigned to the Courts for resolution by the Congress through the APA. Thus, we hold that the doctrine of separation of powers does not apply to bar this Court's determination of the issues presented, and a justiciable question is presented.

3. Unconsented Suit

This issue embodies the defendants' claim of sovereign immunity. Sovereign immunity is a concept which has been widely discussed in the case law, without much consistency, and in a manner which a legal realist would label as rationalization. The controlling case, however, supplies standards which can be applied to the infinite variety of potential factual situations with some rationality, if the application is done with appropriate restraint on rationalization.

Duggan v. Rank, 372 U.S. 609, 619-23 (1963), outlines the law of sovereign immunity. The rule is that a suit is against the sovereign and barred by the doctrine of sovereign immunity if the judgment sought would expend itself on the public treasury or domain, or interfere with the public administration, or if the effect of the judgment would be to restrain the Government from acting or compel it to act. 372 U.S. at 620. There are two exceptions to the general rule. A suit is not barred by sovereign immunity if (1) it alleges that the actions of the officers challenged are beyond their statutory authority, or (2) it alleges that although acting within the scope of their authority, the powers exercised, or the manner in which they are exercised, are constitutionally void.

Application of the rule and its exceptions to these cases is relatively simple, based upon the considerations discussed at length in our treatment of the threshold issue of standing. The rule does not apply because the allegations of the complaints in C-1702 and C-1712 stand squarely within the first exception. Plaintiffs claim that defendant Seaborg as Chairman of the AEC is acting, through his agency and his contractors, Austral and CER, beyond the scope of his statutory authority. They allege that he is acting without due regard to the statutory directives, outlined above, that he give appropriate consideration to the public health and safety when conducting activities such as Project Rulison.

This allegation is sufficient to bring the first exception noted in Duggan v. Rank, *supra,* into play, and we thus hold that the doctrine of sovereign immunity does not bar the suits of the plaintiffs in C-1702 and C-1712.

4. Scope of Review

Defendants admit in their brief filed February 17, 1970 that the scope of review in this action is delineated by the APA, whether standing for review is available under the APA or the general equity jurisdiction of the Court. The APA did not change the existing law of review, according to defendants, and the governing provision is found in 5 U.S.C.A. § 706:

Scope of Review

To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law, interpret constitutional and statutory provisions, and determine the meaning or applicability of the terms of an agency action. The reviewing court shall —

(2) hold unlawful and set aside agency action, findings, and conclusions found to be—

(A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;

(C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right. . . .

In this case plaintiffs assert and defendants do not seem to contest the fact that the Atomic Energy Act directs the AEC to conduct its activities in such a manner as to protect the public health and safety. The specific provision authorizing the activity in the nature of the Rulison Project is 42 U.S.C.A. § 2051. That provision authorizes research assistance by the AEC, and in subsection (d) states:

The arrangements made pursuant to this section *shall contain* such provisions (1) *to protect health,* (2) *to minimize danger to life* or property, and (3) to require the reporting and to permit the inspection of work performed thereunder, as the Commission may determine. (Emphasis added)

Defendants urge, however, that the phrase "as the Commission may determine" places the nature of the arrangements within the agency discretion. The Court agrees with this construction of the statutory language. We note, however, that provision for health and safety is mandatory, since the language is "shall contain". Thus, the statute requires provision for health and safety, but the exact nature of the arrangements is lodged in the discretion of the AEC.

The APA dictates that this Court limit its review to whether the safety and health arrangements of the AEC for the Project Rulison flaring constitute an abuse of discretion. The question of abuse of discretion must itself be narrowed, and in making such evaluation full consideration will be given to the fact that the AEC possesses an extraordinary amount of experience and expertise in the area of atomic energy and atomic radiation. However, we note that the AEC is almost exclusively in the possession of the experience and expertise in these areas. Thus, there is clearly a necessity for review to insure that the AEC discretion does not become a citadel impregnable to challenge by the concerned public, to insure that it is not so exercised as to fail to satisfy the standard established by law, that is, the protection of public health and safety. We hold that plaintiffs do not seek review of discretionary acts immune from judicial review.

5. Is Rulison Flaring Within Statutory Authority

Determination of the fifth issue of law is dependent upon the determination of the factual issue presented, and the subsidiary factual issues. The fifth legal issue will therefore be dealt with later in this opinion.

6. Order to Supply Information

This issue as put forward by plaintiffs is wholly without merit. Plaintiffs have furnished no authority for the proposition that the AEC must answer for all of its activity to any inquiring member of the public. The AEC is answerable to the Joint Committee on Atomic Energy of the Congress, and this Committee is the guardian of the public interest in the utilization of atomic energy. The only other way in which a member of the public can show himself entitled to an order directed to the AEC to provide information is to make a prima facie showing of standing to challenge the agency action in a legal action and utilize discovery procedures.

ISSUES OF FACT

The focus of the two cases at trial was on the proposed flaring of the gas from the Rulison cavity. All of the subsidiary factual issues outlined above are phrased in terms of the plans of the AEC for this flaring. Before considering these issues in detail a more thorough outline of the Project and the plans for flaring is essential.

Project Rulison Reentry Plans

The principal evidence of the plans for reentry of the Rulison cavity and the attendant provisions for the health and safety of the public are found in "Defendant's Exhibit N" entitled "NVO-61, Project Rulison Post-Shot Plans and Evaluations". We will, as briefly as possible, summarize the contents of this publication, supplementing it as necessary from the record at trial.

1. *Effect of Detonation*

The yield of the Rulison fission device was 40 kilotons. The cavity formed by the detonation collapsed 40 seconds after the detonation to form a chimney. The radius of the cavity is estimated to be from 72 to 108 feet, the radius of cracking of surrounding rock from 390 to 580 feet, and the chimney height from 301 to 451 feet. The volume of the cavity is predicted to be from 1,560,000 cubic feet to 5,280,000 cubic feet, and the volume of the chimney is predicted to be from 4,900,000 cubic feet to 16,500,000 cubic feet. We will refer to the cavity-chimney combination as the "cavity" in this opinion. One goal of the planned flaring of the cavity gas is to more accurately determine these cavity dimensions and the radius of cracking of surrounding rock.

The pressure in the cavity at the time of reentry is predicted to be within 50 pounds per square inch (psi) of the original reservoir pressure of 2,940 psi. The temperature of the gas in the cavity is estimated to be 375° F.

A table of radionuclides produced by the Rulison device is contained in Exhibit N; most of these are in the rubble in the cavity, and only the few which are gaseous at cavity temperature and lower temperatures will be present in the flared gas. The ones with which we are most concerned in these cases are tritium and krypton 85. Prior to flaring the AEC is unable to determine the exact distribution of the critical radionuclide tritium among the various cavity gases.

However, at the trial, Dr. Alfred Holzer testified at length on the tritium distribution in cavity gas. Dr. Holzer is a physicist at the Lawrence Radiation Laboratory of the University of California at Livermore, California, where he is a Deputy Division Leader. He was the Project Scientist in charge of nuclear effects in connection with Project Gasbuggy, the previous nuclear stimulation experiment. It appears from his uncontroverted testimony that within the Rulison cavity will be rubble, water and gas. The tritium in gaseous form will constitute 19% of the tritium produced, and of this, 7% will be found in the Methane gas, 12% will be in the hydrogen gas. The other 81% of tritium formed will be in the water. It is possible that an additional 10,000 tons of water could be liberated from the chimney rock, over and above an estimated 2,500 tons to be boiled from rock by the detonation. If this additional water is liberated, the tritium distribution will be: Methane 7%; hydrogen 2%; and water 91%. Dr. Holzer's testimony established that the tritium distribution within the cavity is different from that to be expected in the gas-water vapor mixture at the wellhead at the time of flaring. The wellhead distribution will depend upon the variables of the pressure, the volume flared, and the speed of flaring.

Based on the data from Gasbuggy, Dr. Holzer was of the opinion that 14% of the tritium appearing at the wellhead would appear in water vapor and 86% will appear in the other gases. He further opined that, ignoring the Gasbuggy information, 21% of the tritium at the wellhead will be in water vapor. He also broke this down, indicating that 3% of the tritium at the wellhead will be in water in the liquid form, and 18% will be in water in the vapor form. Plaintiffs offered no competent evidence challenging these opinions.

2. *Reentry Plan*

Reentry into the Rulison cavity is planned through the R-EX Well after preliminary operations at the R-E Well where the device was detonated. Hereinafter the site of the R-E Well and the general area adjacent will be referred to as Surface Ground Zero (SGZ). The preliminary operations at the R-E Well will be to determine the ability of that well to produce natural gas, and the gas produced from this well will be analyzed for radioactivity.

The R-EX Well is located approximately 300 feet southeast of R-E. This well is an exploratory

well drilled early in the Project to determine the reservoir pressure, and utilized for pre-detonation production testing to determine the productivity of the reservoir. Prior to the detonation this well was sealed, utilizing a combination of cement plugs, water, and bridge plugs. At the wellhead a "Christmas tree" was placed to suspend a part of the various well casings, and this Christmas tree contains fittings for valves and pressure gauges to be used in the reentry process.

The details of reentry drilling and controls for the drilling operation indicate that the AEC and Austral have taken all of the customary safety precautions to prevent a blowout at the wellhead. Reentry will be under the supervision and control of the AEC. All of the equipment used in the drilling on reentry (hereinafter "drillback") has a test pressure at least twice that of designed working pressure, which is 3,000 psi. All materials and procedures used will be in compliance with State of Colorado Oil & Gas Conservation Commission rules and regulations, and the working and test pressure of all equipment will be established within the standards of the American Petroleum Institute.

The reentry plan calls for a drillback from the wellhead of the R-EX Well. During drillback appropriate equipment, conventional in gas well drilling operations, will be utilized to prevent a blowout. The drillback will proceed through the plugs in the R-EX Well to the 6,500 foot depth, at which point a whipstock will be placed. This whipstock will permit deviation in the drilling below that depth in order to allow the drill to be veered to eventually intersect the chimney created by the detonation near its top.

The maximum hypothetical accident calculation, to be dealt with in detail in the discussion of the safety plan, is based on a blowout and the subsequent release of all cavity radionuclides within twenty-four hours. The blowout is, if a possibility at all, remote in the extreme in view of the apparatus and procedures which the evidence indicates will be utilized in the drillback operations.

A conventional mud circulation system will be used during the drillback. This system pumps drilling mud down the drill pipe and up the annular space between the drill pipe and casing or open hole. As the drillback approaches the cavity, any radioactivity encountered will be evidenced in the mud. This mud is to be monitored for radioactivity. Any radioactive gas in the mud circulation system will be removed in a separator in the system and flared through the flare stack. When communication with the cavity has been made and it is reasonable to assume that the greater radioactive contamination of the mud will occur, the drilling mud will all flow into the cavity, thereby insuring that the majority of the radioactivity contained in the mud will not reach the surface. A shroud will cover the wellhead and in the event, highly unlikely, that gas does escape at the wellhead, it will be drawn off and flared.

3. *Production Testing*

After the completion of the drillback and fitting of the wellhead equipment for the production testing, the following tests are planned. First will be a short-term, high-rate flow test series under various meteorological conditions to assure operational readiness of monitoring systems. The maximum volume of gas to be flared is less than 20 MMSCF (million standard cubic feet). Short-term, high-rate flow testing to evaluate the cavity volume is the second test. This is expected to take three weeks and will release a total volume of 100 to 200 MMSCF. Third will be a series of intermediate term, lower rate flow tests to evaluate dimensions and flow characteristics of the fracture zone. This will take two months, and will release a total volume of 100 to 200 MMSCF, with a maximum flow rate of 5 MMSCF per day. Finally, a long-term production testing and partial buildup series will be conducted. This series will take six to eight months and will release a total of 300 to 600 MMSCF with maximum flow rates of 5 MMSCF per day. Thus, the contemplated total release of gas during the flaring is 500 to 1,000 MMSCF.

The monitoring program for radioactivity in the gas stream which will be released to the atmosphere in the flaring programs outlined above is detailed "Defendant's Exhibit XXX, the Affidavit of Jerome E. Dummer, Jr." Mr. Dummer is a group leader at the Los Alamos Scientific Laboratory and is responsible for providing health

physics advice to the Operations Director of Rulison in conjunction with the reentry and flaring.

The gas produced by the well during the flaring operations will be processed by a "separator" into three product streams. One stream is the gas stream, which will be discharged from the separator directly into the 70 foot high flare stack. Another stream is the water stream, which, after analysis for radioactivity, will be converted into steam and injected into the flare. A representative sample of this water in the separator will be collected and analyzed for tritium and other forms of radioactivity. The third product stream will be condensate, a hydrocarbon liquid comparable to a low-grade gasoline. The condensate will be analyzed for radioactivity in the same manner as the water, and then will be discharged into the flare stack.

The monitoring system to be employed at the wellhead site during the flaring consists of four basic elements: 1) STALLKAT; 2) freeze trap; 3) particulate filter and activated charcoal cartridge; and 4) gamma monitor.

The STALLKAT (System to Analyze Low Levels of Krypton and Tritium) will analyze continuously the gas flow from the well for low levels of krypton and tritium. This system has a detector and a readout allowing continuous monitoring, providing an instantaneous reading of the total amount of the radionuclides released. This system will permit the Operations Director supervising the flaring to know if the concentrations of release exceed that expected.

A freeze trap is a device which will be placed in the main flow line to monitor any moisture in the gas. It will monitor tritium being released in water vapor form through the flare stack, which the STALLKAT will not.

The particulate filter and activated charcoal cartridge will be placed in the flow line. The filter will determine if any particulate beta or gamma radiation is present in the gas. Since such radioactivity is not anticipated, the filter is merely precautionary. The activated charcoal cartridge will measure any iodine-131 present in the released gas, although none is expected to be present. These two systems will provide continuous sampling of the gas flared. Analysis of the samples will be at least once every eight hours, with increased frequency as conditions may dictate.

A gamma radiation monitoring instrument (geiger counter) will be placed in the flow line to provide instantaneous monitoring of the gross gamma radiation level. This will supplement the particulate filter, which must be removed from the line in order to be analyzed. This device is also precautionary.

This on-site monitoring system will be maintained and operated by the Eberline Instrument Corporation (EIC) as indicated by Exhibit N in evidence and Appendix A to this opinion. Reporting of this data will be to the Operations Director at the site and to the Nevada Operations Office. Subsequently the data will be made available to the public after reproduction at the Nevada Operations Office. It will be placed in the Rulison Open File at Denver, Colorado, Las Vegas, Nevada, and Bartlesville, Oklahoma, and will be forwarded to the Colorado State Public Health Department.

"Defendant's Exhibit BBBB, Project Rulison, Operating Instruction, Reentry Drilling and Production Testing" governs the reentry and flaring and provides operating limits for the release of radioactivity. These limits will implement the radiation protection standards specified in the Rulison Operations Plan (Exhibits F5, F6, F7, F8 and F9), and specifically in the Safety Plan (Defendants' Exhibit F6, Annexes A and B). The Operating Instructions contain "Action Concentration Levels". When these levels are reached by any of the on-site monitoring systems during the reentry drilling or flaring, the operations will be stopped until collection and evaluation of additional data indicate that the operation can proceed within the standards established by the Safety Plan.

4. *Public Safety — Radiation Exposure*

The action concentration levels contained in the Operating Instruction are intended to insure that the radioactivity released with the flaring of the gas does not exceed the Safety Plan standards for radiation exposure of either workers at the site or the general public. The monitoring of the flared gas provides a measure of the quantity of the radionuclides released in the gas. However,

in order to determine the actual exposure of individuals, it is essential to establish concentrations of radionuclides in the environment of the exposed individuals. To this end, the Project Rulison plans call for an off-site Surveillance Plan.

The Surveillance Plan will primarily be under the supervision and control of the Southwestern Radiological Health Laboratory (SWRHL) of the U. S. Public Health Service. This safety responsibility will be discharged by the following procedures. All environmental surveillance for the duration of the drillback and flaring will require surface monitoring supplemented by aerial monitoring. Mobile teams will collect samples prior to release of any radioactivity. These samples will include food and water used by wildlife, domestic livestock and humans, with emphasis on tritium levels.

Monitoring activities will include air sampling through fifteen stations established specifically for Rulison, through four Air Surveillance Network stations of the SWRHL network at Durango, Grand Junction, Denver and Pueblo, Colorado, and eight thermoluminescent dosimeter (TLD) stations in a five-mile radius of SGZ. See Appendix B. These TLDs are instruments capable of highly accurate measurement of radioactivity.

Milk will be sampled through the SWRHL Milk Surveillance stations at eleven Colorado cities. In addition, a SWRHL Rulison Milk Surveillance Network of five Grade A dairies and ten family milk cows has been established to collect milk samples in the Rulison area. See Appendix C. These samples will be analyzed for tritium and other radionuclides.

The SWRHL Rulison Water Surveillance Network will be used to detect radiation in water supplies. Twelve municipal water supplies within twenty-five miles of SGZ plus five other water supplies will have surveillance stations. Five private wells around the site, a special well on Battlement Creek, three springs, four reservoirs and nine streams will be under surveillance. See Appendix D. Samples from these sources will be taken before reentry in order to establish background levels of radiation, and then during reentry and flaring operations, thus allowing accurate measurement of the amount produced by the reentry and flaring operations. Snow will be sampled, and portable precipitation samplers will collect samples of precipitation that may occur during reentry and flaring.

Samples of animal, wildlife, soil and vegetation will be taken prior to reentry, during drillback and during flaring.

To supplement the Surveillance Plan, the Air Resources Laboratory (ARL) of Las Vegas, Nevada, will provide meteorological support. The meteorological support plan calls for design, establishment and operation of a meteorological data gathering system, the provision of weather data and forecasting service, and the provision of predictions of radioactive effluent dispersion from Rulison activities.

The meteorological data gathering system will include a SYSTRAC radio-telemetered instrumentation array to measure surface wind speed and direction. See map, Appendix E. Wind data will be continuously recorded, thus providing information on the local wind and information useful in placing manned sampling stations. Surface temperature and humidity will also be measured and recorded at the site. Upper level winds will be measured by pilot ballons (pibals), and an ARL Ground Meteorological Device will provide vertical temperature, humidity and wind soundings. These soundings will provide data essential to determination of atmospheric stability which will allow prediction of effluent plume dispersion.

All of the data gathered under the Surveillance Plan and the Meteorological Support Plan will be reported to the Operations Director and the Nevada Operations Office and disseminated to the public via open files in the same manner as the data gathered by the on-site monitoring system.

5. *Maximum Hypothetical Accident*

"Defendant's Exhibit N" postulates a "maximum hypothetical accident" in order to assess the potential hazard created by an accidental loss of control over the gas contained in the Rulison cavity. As indicated above in discussion of the reentry plans, technical evaluation of the reentry procedures and equipment indicates that accidental release of all radionuclides is so re-

mote as to be almost impossible. However, in order to completely determine the potential radiological hazards, such an accident is postulated and the resultant radiation exposure is estimated.

The accident would be caused by a "blowout" of the R-EX Well and the complete release of all radionuclides in the cavity gas within a twenty-four hour period. The AEC has made a high estimate of the potential radiation release, has made an estimate of the dispersion of the radioactive gas, and then made alternative estimates of the resultant concentrations. The alternative estimates were made of concentrations resulting from a normal dry deposit of the radionuclides contained in the gas and of a rainout, deposition of all radionuclides during a continuous rain at the time of the blowout and for the duration of the release.

Exposure of human beings to radiation from the accident was estimated for the three methods which would produce the highest dose. These were direct exposure from radionuclides in the air, dose received by the food chain and dose received from drinking water. The dose from the first two exposures would be well below the standard of the Safety Plan, 0.17 rem/yr. Possibly a dose in excess of this standard could be received if drinking water supplies were replenished during a simultaneous occurrence of the maximum hypothetical accident and rainfall. The AEC is relying on its remedial action capability based upon monitoring, sampling and preventive action to assure that cisterns are not filled during such a time.

Subsidiary Factual Issues

1. Do the Rulison Plans make reasonably adequate provision for the protection of the health and safety of human, plant and animal life?

The challenge of the plaintiffs in Civil Actions C-1702 and C-1712 to the proposed flaring of the gas from the Rulison cavity is that the radioactivity present in the gas presents a threat to human, plant and animal life. The concern is primarily with the tritium radionuclide, which is an isotope of hydrogen. However, since krypton 85 is also present, and will be released, the plaintiffs are concerned that it too presents a threat to health. The threat to health alleged is not confined to an immediate effect, but rather plaintiffs' claim that even if the quantities of radionuclides released are so small as to present no immediate threat of injury, the contribution to radioactive pollution of the environment by any release will have a detrimental effect on the health of human, plant and animal life. The legal question presented by these allegations is whether Dr. Seaborg and the AEC have complied with the directive of the Atomic Energy Act, 42 U.S.C.A. § 2051 (d), and made reasonable provisions to protect health and to minimize danger to life and property.

Resolution of this first factual issue presented requires the determination of two things. First, how much radioactivity will be released under the plans for flaring above outlined. Second, what is the effect on health to be expected from this release.

a. *Amount Released*

The evidence discloses that 960 curies of krypton 85 were expected to be produced by the Rulison device and that from 1,000 to 10,000 curies of tritium were expected. The range predicted for tritium production is made in response to the experimental nature of certain aspects of the Rulison device. Tritium production of the device is a function of neutron interaction with the lithium in the rock about the device. The Rulison device had a blanket of boron carbide placed around it to insure that the size of the detonation did not exceed the upper yield limit of the device, 40 kilotons. A desirable side effect of this boron carbide is that it was predicted that the boron would compete with lithium for neutrons, and thus reduce the tritium production of the device.

It can reasonably be expected that if the boron was effective in reducing the tritium production, then 1,000 curies would be produced. If it was not, then 10,000 curies of tritium would be produced by the device. The postulated maximum hypothetical accident of Exhibit N, outlined above, is based on the 10,000 curie figure.

About one week before trial, samples of gas were taken from the top of the R-E Well and analyzed at the Lawrence Radiation Laboratory. The report reveals that the samples contained less than one percent chimney gas, and thus we con-

clude that the analysis cannot be given conclusive weight as to the radionuclide content of the gas in the cavity. However, it is of some evidentiary value. After interpreting the report of the analysis, an expert was of the opinion that the tritium production of the Rulison device was 1,300 curies.

We find that the plans of the defendants thus are based upon a maximum release of 10,000 curies of tritium and 960 curies of krypton 85. We find that the evidence shows that the Rulison device in all probability *produced* significantly less tritium than defendants' plans contemplate.

In the opinion of Dr. Holzer only a relatively small percentage of the total radionuclides that we are concerned with will be released to the atmosphere in the flaring operation. He estimates that the *maximum* percentage of tritium produced by the device which would reach the surface in the flaring operation is 19%; and probably only 9% of the tritium will be flared. Thus, defendants' plans, which provide for the contingency of the maximum hypothetical accident, are based upon a release of tritium at least five times, and as much as ten times, greater than is reasonably to be expected.

Implementation of the operative plans will be under the direct supervision of trained and experienced experts in these fields. When any of the various monitoring systems indicates that radionuclide release during reentry or flaring operations exceeds the established "action concentration levels", operations will be halted. The action concentration levels are designed to keep the release of radioactivity within the AEC and Federal Radiation Council standards.

The Off-Site Radiological Safety and Resident Evacuation Program for Project Rulison, which was used in the detonation phase, will be utilized for the reentry and flaring phase.

We find that the release of a quantity of tritium and krypton 85 equal to that postulated in the maximum hypothetical accident is an improbability. We find that the plans of the defendants call for a release of no more than 960 curies of krypton 85 and no more than 10,000 curies of tritium, over an extended period of time, probably one year. We further find that the evidence, uncontroverted by the plaintiffs, shows that probably no more than 2,000 curies of tritium were produced by the Rulison device, and that the flaring operation will release to the ambient environment no more than 20% of that tritium, or 400 curies. We find that the plans of the defendants and the officials responsible for execution of those plans will reasonably provide for limitation of the release of radionuclides within established levels of concentration.

b. *Health Effect*

Evidence on the health effect to be expected from the release of radioactivity in the Rulison flaring involves several concepts, the initial explanation and clarification of which would be helpful. The "dose" to a human being from exposure to radiation is measured in rems. A rem is the absorbed dosage of radiation (measured in rads) multiplied by the appropriate quality factor. The absorbed dosage depends upon the energy level and concentration of the radionuclide producing the radiation. The quality factor is a number which expresses the radiobiological effect of the radiation, its ability to damage living cells. The Rulison safety plans are in terms of concentrations of radionuclides released. The monitoring at the wellhead will be a measure of curies per cubic foot of gas, or some fraction thereof. The sampling of the surveillance plan will measure radiation in terms of microcuries per unit of volume. Thus, to *measure* the threat to health from the radionuclides released in the flaring operations, it is first necessary to measure the concentration of the radionuclides in various elements of the environment to which a population will be exposed. Then a dose must be calculated. Likewise, in order to *predict* the threat to health from the release, it is first necessary to predict the dispersion of the radionuclides, the resultant concentration in the environment, and then the absorbed dose.

The plaintiffs' challenge to the defendants' claim that the planned release of radionuclides will not present a threat to health is on two levels. At the one level, they challenge the assertion that the plans themselves provide adequate protection for health and safety. At the other level, they claim that although the plans may be adequate in terms of the AEC standards and other accepted standards, the standards them-

selves do not provide adequate protection for health and safety.

The only significant evidence introduced by the plaintiffs in challenging the acequacy of the plans was through the witness, Dr. Orie Loucks. Dr. Loucks is a Professor of Botany and Forestry at the University of Wisconsin who has been working as a systems analyst in environmental problems. His opinion is that the AEC has made an inadequate ecological study, that distribution and resultant concentration of the radionuclides cannot be predicted, and that therefore the potential threat from the release is not accurately predicted in the plans. He thinks that a major study is necessary of tritium, its activity and movement through the atmosphere, water and bioligical transport systems. Such a study would cost $4 million and would take about four years.

Defendants countered by offering the opinion of Dr. Vincent Schultz, formerly of the Division of Biology and Medicine of the AEC and currently a Professor of Zoology at Washington State University. His opinion is that the release of tritium from the Rulison flaring is of such an insignificant amount that no detectable ecological effect will result. This opinion is in agreement with the results of the AEC study found in Exhibit N, Appendix B.

The Court is not in a position to evaluate a scientific controversy of great sophistication, and this controversy as to methodology is certainly more sophisticated than the conventional problems with which we are faced. However, we fortunately need not make such an evaluation to decide the issues presented in this case. The question that we must resolve here is whether or not the evidence establishes that the plans for the release and flaring of the gas are inadequate to provide a reasonably certain and rational basis for predicting that no danger to health and safety will result therefrom. The controversy as to the necessity of a complete ecological analysis of tritium distribution need not here be resolved if in fact an accurate prediction can be made from the information provided by the defendants' studies. Such a prediction has been made, is in evidence, and its reasonableness has not been challenged.

Dr. Victor Bond, a medical doctor with a Ph.D. in medical physics, who is the Associate Director of Brookhaven National Laboratory in charge of Live Sciences and Chemistry, testified as to the properties of tritium and krypton 85 and the dose to be expected from the release of these radionuclides in the flaring. He testified that a dose of radiation from tritium is the same as a dose of radiation from X-rays. He stated that the quality factor of tritium is to be revised downward from 1.7 to 1.0, meaning tritium has a lesser ability to damage living cells than was previously thought. In conventional terms, tritium does not concentrate in the human body.

Dr. Bond stated that the discharge of 1,000 curies of krypton 85 into the atmosphere in the Rulison area will not constitute a medical hazard. He stated that if 2,000 curies of tritium are released at the Rulison site over a one-year period (as the flaring plans contemplate), and this amount is deposited in the environment at a rate and in concentrations consonant with the normal precipitation pattern, the maximum dose any person will receive will be 0.0025 rem.

In order to place this dose in perspective, he gave the dose received from common sources of radiation. A chest X-ray exposes a man to 50 milliroentgens, which is about twenty-five times the maximum predicted dose from Rulison. A round trip between New York and Denver in a jet airplane at high altitude will expose a man to a dose equal to that predicted from Rulison. The 0.0025 rem dose from Rulison is equal to the dose from solar radiation a person would receive by spending two weeks at a high altitude ski resort in Colorado. A person who lives in a concrete house rather than a wooden house will receive 100 millirads more of a radiation dose, which is fifty times the upper limit of the dose from the Rulison flaring. In his opinion, 0.0025 rem dose would not constitute a health hazard.

The plaintiffs offered no substantial evidence to contradict this testimony. The Court notes the testimony offered before the Subcommittee on Air and Water Pollution of the Committee on Public Works of the Senate by Dr. Radford (November 18, 19 and 20, 1969), and finds that it does not controvert the testimony of Dr. Bond that the dose from the Rulison flaring will not constitute a threat to health. Plaintiffs' cross-

examination did not in any way weaken or bring out contradictions in Dr. Bond's testimony.

We therefore find that the preponderance of the evidence shows that the Rulison plans for the release from the cavity of gas containing a maximum of 3,000 curies of radionuclides make reasonable provision for the protection of the health and safety of human, plant and animal life.

2. Are these plans for flaring of gas within the radiation protection standards of the AEC and the Federal Radiation Council?

Resolution of this issue requires only the establishment of the accepted radiation protection standards and the comparison of the expected radiation dosage from the Rulison flaring.

"Defendant's Exhibit L, U. S. Atomic Energy Commission Chapter 0524 Standards for Radiation Protection" establishes the AEC standard. The standard for individuals and population groups in uncontrolled areas for whole body, gonad or bone marrow exposure is 0.5 rem for critical individuals at points of maximum probable exposure, and 0.17 rem for an average dose to a suitable sample of the exposed population. There is testimony throughout the record referring to these standards, and there is no controversy as to its value.

Exhibits I and J are reprints from the Federal Register of FRC memoranda to the President providing Radiation Protection Guidance for Federal Agencies. Exhibit I is dated September 6, 1961 and provides a "Radiation Protection Guide" for individuals in the population of 0.5 rem per year. It also states that where individual whole body doses are not known, a suitable sample of the exposed population should be developed whose protection guide for annual whole body dose will be 0.17 rem per capita per year. There is no controversy as to the value of the FRC radiation protection standards.

We find that the AEC and FRC standards for radiation exposure is 0.5 rem per year for individuals whose dose can be measured and 0.17 for an average dose to an exposed population. We also find from the uncontroverted testimony of Dr. Bond that there is no reasonable possibility for a dose to the population exposed to the gas flared from the Rulison cavity to exceed 0.0025 rem. We therefore conclude that the dose to the population in and about the Rulison site resulting from the flaring is thus well within the standards of the AEC and FRC.

3. Are the defendants prepared and equipped to actually implement the plans for flaring, thus insuring the protection of health and safety?

This issue was raised at the trial primarily by the evidence introduced by plaintiffs to show that defendants detonated the Rulison device at a time when the actual wind direction was not within the sector which AEC plans called for. Plaintiffs thus sought to establish that defendant AEC has a "credibility gap" and cannot be relied upon to follow its own established standards and safety plans.

The evidence shows that according to the AEC Director of Nuclear Operations for Project Rulison the nuclear device was to be detonated only when any radioactive material released could travel in a sector from 90° to 145° with reference to ground zero. (Defendant's Exhibit F, page 4, not Defendant's Exhibits B or D as the transcript states.) The Court takes judicial notice of the fact that wind direction is measured and recorded in terms of the direction *from* which it blows. The Court also notes that in order to insure deposition of radioactive release in a 90° to 145° sector, the wind would have to be from a direction of 270° to 325°.

We find that at the time of the detonation of the Rulison device at 3:00 p.m. Mountain Daylight Time, September 10, 1969, the wind at the surface at ground zero, as measured at the Rulison wind tower, was from 330° at 4 mph. The wind measured at a tower 1.6 miles to the northwest of SGZ was from 300° at 2 mph. The wind 1.75 miles southeast of SGZ, measured at the Rulison wind tower on the edge of Battlement Mesa, was from 280° at 6 mph. The wind in the vicinity of SGZ was therefore within the AEC criteria, for any radioactive release would travel from SGZ to the southeast to the top of Battlement Mesa. We find that the wind from this point on the top of Battlement Mesa and east of there up to an altitude of 13,000 feet was from 270°, and that any radioactive release would travel easterly, within the established sector.

These conclusions are not inconsistent with plaintiffs' evidence that the wind at the surface on Morrisania Mesa at the time of the detonation was from the northeast. The topographical configuration of the Colorado River valley and the mountains rising to the southeast may cause a difference in wind direction between two locations approximately three miles apart. Nor is our conclusion inconsistent with plaintiffs' evidence that the "mean winds" calculated from Exhibit UUU were 10° outside of the AEC's established sector. In our opinion, evidence of "mean winds" is not relevant to the determination of whether or not the AEC stayed within its criteria, since it describes a conclusion reached after a mathematical averaging of winds at various altitudes measured at various locations. The "mean wind" provides no evidence of what the wind was at SGZ at the time of detonation, and what direction any radioactive release would have traveled in over the actual topography to the southeast of SGZ.

We therefore find that the AEC detonated the Rulison device when the wind was from a direction that would make any radioactive release travel in a sector from 90° to 145° with reference to SGZ. We find no evidence of an AEC "credibility gap", and no evidence that the AEC cannot be relied upon to implement its plans for the Rulison flaring within the standards it has established and published.

4. Are there safe economical alternatives to the proposed flaring as a means of determining the effectiveness of the Rulison detonation?

Plaintiffs sought through one witness of their own and through cross-examination of defense witnesses to establish that there are safe, economical alternatives to the proposed flaring, or that the defendants failed to fully explore possible alternatives. Plaintiffs wholly failed to establish that there are reasonable, safe and economically feasible alternatives to the planned flaring. We find that the proposed flaring is itself a reasonably safe plan for evaluation of the effectiveness of nuclear stimulation. Because, as we have already found, the radionuclides to be released in the flaring present no threat to the public health and safety, and because the plan for flaring is thus a reasonable exercise of the administrative discretion of the AEC, we find that the AEC is under no duty to further explore, to the point of exhaustion, available alternative methods of evaluating the experiment.

5. Are the FRC and AEC radiation protection standards reasonably adequate to protect life, health and property?

Much of the evidence and testimony produced in this trial goes to this particular issue, which is, in essence, an attack on the validity of the accepted radiation protection standards. The principal evidence going to this issue came from the testimony of seven witnesses and the "Defendant's Exhibits RRR through RRR-J". Two of the witnesses are standard setters: Dr. Paul C. Tompkins, Executive Director of the Federal Radiation Council, and Dr. Lauriston S. Taylor, a founder, and the Chairman and President of the National Council on Radiation Protection and Measurements throughout its existence. Dr. Arthur Tamplin, a biophysicist at the Lawrence Radition Laboratory of the University of California, is the joint author of a paper attacking the standards. Dr. Theodore Puck, a Professor of Biophysics and Director of the Roosevelt Institute for Cancer Research at the University of Colorado, testified for the plaintiffs. Dr. Robley Evans, Professor at the Massachusetts Institute of Technology, Dr. Arthur C. Upton, a medical doctor who was the Chief of the Pathology-Physiology Section at the Oakridge National Laboratory until July 1969, when he left to become a professor of pathology, and Dr. John Storer, a medical doctor, Deputy Director of the Division of Biology and Medicine of the AEC, testified for the defendants in defense of the standards.

The evidence shows that the radiation protection standards of the AEC are in substantial agreement with the permissible individual dose levels for members of the public as adopted by the National Council for Radiation Protection (NCRP), the Federal Radiation Council (FRC), the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA). These generally accepted standards have gone through three stages. In about 1934 a standard or guideline of 0.1 roentgen/day was adopted by the NCRP. At this time the standard applied only to radiation work-

ers. In about 1949 the standard was changed to 0.3 roentgen/week for radiation workers. This change was due to the expanded use of atomic energy and was not made for biomedical reasons. In 1957, in response to evidence of the genetic effects of radiation, the standard was again changed, and set at 5 rem/year for radiation workers. At this time a standard was established for individuals in the general population of 0.5 rem/year. The method by which this standard is to be implemented is by maintaining a standard of 0.17 rem/year average dose to a sample of the exposed population.

Thus, we find that the history of the radiation protection guidelines indicates a consistent lowering of the value of permissible dose for radiation workers. However, this lowering has not been, in all instances, in response to evidence of the biological effects of radiation. There is no history of lowering of standards for general population exposure. There has only been one such standard.

Radiation protection standards are established by the various agencies through a complex process. This process entails the review and evaluation of studies of the biological effects of radiation. These studies attempt to ascertain the risk to humans from radiation exposure. The agencies also study the utilization of radioactive processes and materials in order to establish the benefits to be derived from radiation exposure. The setting of exposure standards at a given level requires the weighing of these risks and benefits to be derived therefrom. The weighing requires a value judgment as well as a measuring, and thus the standards are not scientific numbers below which no danger exists. The value judgment embodies complex social and political considerations, for atomic energy has a potential that suggests unlimited benefits to entire nations and presents a risk to entire populations of people, and perhaps their progeny.

We find that the standards, as presently established, do embody this risk-benefit evaluation, and we are of the opinion that this Court is not faced with the determination of a risk-benefit question for the specific Rulison project. Although at trial we received a significant amount of evidence going to the need for the natural gas locked into the Mesaverde formation of the Rulison field, the reserve-production ratio, the proved gas reserves, and the potential gas reserves, we believe that the decision of the extent and nature of government participation in development of energy sources is a political question for the Congress. It is for Congress to decide, as the representatives of the people, which energy sources to develop, and how to develop them. It is for Congress, in making these decisions, to weigh the risks presented by the use of atomic energy in such projects. Our task here is to insure that the AEC has not exceeded Congressional standards established to protect the public in a utilization of atomic energy which Congress has authorized, presumably after having evaluated the risk-benefit equation presented by the Rulison project.

The protection standards as presently established without question embody a policy of source management. Such a policy requires the control of radiation exposure by a control of sources of radiation. Although the plaintiffs sought to establish that the plans for the Rulison flaring constitute a departure from this policy, we expressly find that they in fact do not constitute such a departure. The radionuclide production of the Rulison device has been contained within the cavity for six months, thus providing time for all radionuclides with a short half-life to deteriorate. The controlled release of the Rulison gas and its constituent radionuclides will be monitored and an excessive concentration will dictate the cessation of operations.

These standards are based on the conservative assumption that there is a linear relation between the dose received and the damage to living cells, the assumption that for every fraction of a rem exposure there is some injury, although perhaps too minute to be detected. "Dose", as explained above, is the amount of radiation received and must be distinguished from "dose rate", which is the speed at which a given amount of radiation is received. If a given amount is received very rapidly, in a second for instance, it is received at a higher dose rate than if it is received over a time span of several minutes or hours. The "linear assumption" ignores dose rate, the significance of which will be discussed later, and assumes that there is some injury at low

dose levels regardless of dose rate, although no evidence was produced to validate the assumption. We find that the adoption of this assumption constitutes a conservative approach by the standards setters and does not constitute a recognition of the scientific validity of the linear theory.

There has been a history of disagreement with the established radiation protection standards on the part of some members of the scientific community. The basis for this disagreement has often been the fact that science has been unable to fully discover the biological effects and costs of ionizing radiation. This lack of knowledge is not the product of insufficient scientific inquiry, but rather of the complexity of the problem presented. This ignorance makes it impossible to assess fully the risks attendant to exposure to ionizing radiation. Disagreement with the standards is thus often a manifestation of a value judgment that it is wrong to set a standard which may in fact turn out in the future to have been wrong. It appears to us that the "scientific" disagreement in such cases, where there is no evidence of biological effects from radiation at levels below the standards, may in reality be a disagreement with the value judgment that utilization of materials and processes which produce radiation should proceed even though all risks may not be known. This value judgment in the context of the facts developed in this case, as we indicated above, is in our opinion reserved for politically responsive institutions within our governmental framework, not the courts. Thus, the evidence of historical disagreement with the radiation protection standards has little probative value where the issue presented for resolution is the scientific validity of the standards.

The plaintiffs sought to prove that the present standards are too high and should be lowered by a factor of ten. We find that they failed to establish this proposition with competent evidence. They claimed that "new evidence" of the effects of ionizing radiation, "hard evidence", indicates the necessity of such a lowering of the acceptable exposure levels. Plaintiffs offered, through the testimony of Dr. Puck, evidence of a correlation between chromosomal aberrations and irradiation of chromosomes, which evidence has developed since the present standards for population exposure were established in 1957. Dr. Puck testified that these chromosomal aberrations cause serious congenital abnormalities, and although there is no direct evidence that the aberrations causing such defects are caused by irradiation of the chromosomes, these aberrations can be mimicked in the laboratory by irradiation of the chromosomes. Evidence was also offered of the expansion of knowledge in the field of human genetics, which may have illuminated effects of ionizing radiation unknown in 1957. Dr. Puck stated that this evidence provided reason to be cautious, and in his opinion dictated a review of the exposure standards. We agree that these standards should be continually reviewed and revised when the scientific and medical knowledge suggests such revision.

However, although the plaintiffs did introduce impressive evidence of new developments in the field of radiation biology, they failed to prove that these developments show the necessity of lowering the standards. The failure of proof has two elements. First, they did not establish an adequate correlation between this information and radiation exposure at low dose levels. Second, they did not refute equally new and impressive evidence of repair of the biological damage from radiation at low dose rates and levels.

The first element can itself be divided into two distinct problems. One is the methodology utilized in arriving at the conclusion that the standards should be lowered by a factor of ten, and the other is that there is no evidence of biological effects from radiation at low dose levels. First, the evidence shows that Dr. Tamplin and his associate Dr. Gofman used data of radiation exposure at high dose levels, utilized the linear assumption, and extrapolated to arrive at the conclusion that cancers are induced by radiation at low dose levels. This method has been reviewed, according to Dr. Storer, and disagreed with by members of the scientific community. The use by Tamplin and Gofman of the "doubling dose" in predicting the incidence of cancer is also questioned, since this concept has primary applicability in the study of genetic effects of radiation and of the mutations produced thereby.

Dr. Tamplin stated that his conclusions were *not* based on evidence of radiation effects at low

dose levels. Nor did the plaintiffs produce any evidence of a causal relation between radiation exposure at low dose levels and chromosomal aberrations. Thus, although the plaintiffs claim that their demand for a lowering of the standards is supported by "hard evidence", they have failed to produce in this Court any "hard evidence" of radiation effects at or below the low dose levels of the radiation protection standards.

A substantial amount of uncontradicted evidence of recovery from the effects of radiation was introduced in this case. Recovery is the ability of a biological mechanism exposed to radiation to repair the damage done by the radiation. Dr. Puck testified that the essence of the radiation damage to living systems is a random disorganization of the complex order of the system. It is this order which makes the molecular structure a living organism. Dr. Evans and Dr. Upton both testified that their experimental work has produced data which suggests that at the low dose levels of the protection standards living cells are able to repair the damage done by radiation. Dr. Evans' research deals with human beings who have received dosage from radium, and Dr. Upton's deals with research done on mice. Their data reveal that the ability of the repair mechanism to function depends upon dose rate. Repair of damage is more complete when radiation is received at low dose rates.

This evidence of repair and recovery from radiation damage has been characterized as evidence which supports a theory of a "threshold" or a "practical threshold". The *threshold* assumption is that below certain levels of dose or dose rate the repair mechanism keeps abreast of the insult, and the exposed organism suffers no permanent damage. The *practical threshold* theory postulates that at certain higher levels of dose or dose rate the repair mechanism cannot keep abreast of the damage to the cells from radiation, but that the cumulative damage to the body is not sufficient to manifest itself during the lifetime of the exposed person. Thus, if in fact the cumulative damage would cause cancer, the time that would be required for a tumor to appear would exceed the life-span.

We find that the evidence of repair provides support for the theories of threshold and practical threshold and has not been controverted. This evidence was not taken into consideration in the establishment of the current standards, as indicated in the following quote from the FRC Memorandum for the President dated May 13, 1960, Exhibit 1:

> Although ionizing radiation can induce genetic and somatic effects (effects on the individual during his lifetime other than genetic effects), the evidence at the present time is insufficient to justify precise conclusions on the nature of the dose-effect relationship at low doses and dose rates. Moreover, *the evidence is insufficient to prove* either the hypothesis of a "damage threshold" (a point below which no damage occurs) or the hypothesis of "no threshold" in man at low doses. (emphasis added).
>
> If one assumes a direct linear relation between biological effect and the amount of dose, it then becomes possible to relate very low dose to an assumed biological effect even though it is not detectable. It is generally agreed that the effect that may actually occur will not exceed the amount predicted by this assumption.
>
> *Basic biological assumptions.* There are insufficient data to provide a firm basis for evaluating radiation effects for all types and levels of irradiation. There is particular uncertainty with respect to the biological effects at very low doses and low-dose rates. It is not prudent therefore to assume that there is a level of radiation exposure below which there is absolute certainty that no effect may occur. This consideration, in addition to the adoption of the conservative hypothesis of a linear relation between biological effect and the amount of dose, determines our basic approach to the formulation of radiation protection guides.

Thus, although we do not accept evidence of repair as conclusively establishing the scientific validity of the threshold theories, we do accept it as satisfactory rebuttal of plaintiffs' evidence for lowering of the standards, since the standards as established are more conservative than this evidence would indicate they need be.

The field of radiation protection is constantly changing with the appearance of new scientific

knowledge on the biological effects of ionizing radiation. Careful decisions must be made in the context of contemporaneous knowledge. Such decisions cannot be indefinitely postponed if the potentials of atomic energy are to be fully realized. All that is required to establish reasonableness of the decision setting a standard under the statutory directive to protect the public health and safety is that it be made carefully in light of the best of available scientific knowledge. Absolute certainty is neither required nor possible. *See* Green v. American Tobacco Company, 304 F. 2d 70 (5th Cir. 1962), and subsequent litigation concerning the connection between cigarettes and cancer. *See also* Yannacone v. Dennison, 285 N.Y.S. 476 (Sup. Ct. Suffolk Cnty. 1967).

The law provides a strong presumption of validity and regularity when administrative officials decide weighty issues within the specific area of their authority and the burden is on the plaintiffs to overcome this presumption. Lewes Dairy, Inc., v. Freeman, 401 F. 2d 308, 316 (3rd Cir. 1968); Udall v. Washington, Virginia and Maryland Coach Co., 398 F. 2d 765, 769 (D.C. Cir. 1968); Braniff Airways, Inc., v. C.A.B., 379 F. 2d 453, 460 (D.C. Cir. 1967). The defendants have provided substantial evidence to support the validity of the standards as currently established, and the plaintiffs have not met their burden. We therefore find that the plaintiffs have failed to establish that the FRC and AEC radiation protection standards are not reasonably adequate to protect life, health and safety. We note that our previous findings in this opinion permitted the avoidance of this issue completely, for the uncontroverted evidence is that the dose to be expected from the Rulison flaring is 0.0025 rem. The FRC and AEC standards are sixty-eight times greater than this dose. If the standard was lowered by a factor of ten as urged by the plaintiffs, the revised standard would still be six and eight-tenths times greater than the dose to be expected from the Rulison flaring.

Having determined the five subsidiary issues of fact presented by this case, we find that the ultimate issue of fact must be resolved in favor of the defendants. The proposed flaring of gas from the Rulison cavity has not been shown to present a danger to life, health or property of the plaintiffs, or any others similarly situated.

Fifth Legal Issue

Our findings and conclusions on the factual issues show that this phase of the Rulison project and its flaring phase do not present a threat to health and safety. They show that the AEC has planned its activities and is carrying them out with all due regard to the health and safety of the public. They show that the radiation dose from the flaring will be within the radiation standards of the AEC and other radiation protection institutions. They show that in the event of an accident which creates a danger of an excessive exposure, plans will be implemented to limit exposure to the established guidelines. Thus, plaintiffs have failed to show the probability of irreparable damage if the flaring is not enjoined, and have failed to establish a right to the specific injunctive relief sought. Crowther v. Seaborg, 415 F.2d 437, 439 (10th Cir. 1969).

We conclude that the evidence shows that the AEC is following the Congressional mandate and its own rules and regulations, and that the actions and plans of the AEC in the prosecution of the conclusory phase of Project Rulison constitute a reasonable exercise of its statutory authority to conduct research in the utilization of atomic energy while providing for the protection of the health and safety of the public. 42 U.S.C.A. § 2051(a), (d).

Lest our ruling today be misunderstood, some additional words are required. This opinion, our findings, conclusions and ruling apply only to the specific factual situation presented by this litigation. We approve only of the flaring of the gas from the one well in the Rulison unit in which a nuclear device was detonated on September 10, 1969. We are not here and now approving continued detonations and flaring operations in the Rulison field. Such determination must be made in the context of a specific factual situation, in light of contemporary knowledge of science and medicine of the dangers of radioactivity, at the time such projects are conceived and executed.

Further, although we have found that the plans for the flaring do provide reasonably for the health and safety of the public and that the specific plans for surveillance are reasonable, we determine that the Court should retain jurisdiction in order to insure that the plans we today

approve as reasonable are in fact reasonably and safely executed. To aid this retention of jurisdiction we further determine that the defendants should file with this Court data and reports of the information collected by the surveillance system outlined in Appendix A.

This memorandum opinion and order shall serve as the findings of fact and conclusions of law of the Court as required by Rule 52 of the Federal Rules of Civil Procedure.

It is therefore

ORDERED that the complaint in Civil Action C-1722, Dumont v. Glenn Seaborg, et al., shall be and is hereby dismissed. It is further

ORDERED that the requests of the plaintiffs in Civil Actions C-1702 and C-1712 for a permanent injunction enjoining the defendants from the flaring of the gases contained in the Rulison cavity shall be and is hereby denied. It is further

ORDERED that defendant Glenn Seaborg or his responsible agent comply fully with the information and data dissemination plan outlined in Appendix A to this opinion, insuring the distribution of such data to the Rulison Open File as indicated, the Colorado State Public Health Department, and also to this Court, when they first become available. It is further

ORDERED that the Court shall and it hereby does retain jurisdiction of the parties and subject matter of this proceeding for purposes of assuring that further activities in connection with this phase of the Rulison Project will be carried out in accordance with the plans as approved by the Court, and for such other and further action as may be deemed appropriate in the premises.

DATED at Denver, Colorado, this 16th day of March, A. D. 1970.

BY THE COURT:

ALFRED A. ARRAJ, *Chief Judge*
United States District Court

APPENDIX A

PROCEDURES FOR PUBLIC DISSEMINATION OF PROJECT RULISON RAW MONITORING AND RELATED DATA

In order that the public and the scientific and industrial communities might be kept informed on joint Industry-Government Plowshare projects, the Open-File System was established on October 23, 1968. Open Files were established in Denver, Colorado; Las Vegas, Nevada; and Bartlesville, Oklahoma. Open-File data on the first joint Industry-Government Plowshare project, Project Gasbuggy, included preliminary unevaluated data and data analyses. Final reports, published and disseminated through AEC and technical-journal channels, are also displayed at the Open Files.

Set forth below is a description of the raw monitoring and related data for the well re-entry and testing phase of Project Rulison which are planned to be placed in the Open Files, and the procedures relating thereto. In addition to the data described below, the Project Rulison final reports, containing evaluations of the subject data and other project information will also be displayed at the Open Files after their publication. These reports entail extensive analysis and interpretation of project data which, in turn, dictates the time required for their preparation and publication.

The data described below and the final project reports will, in addition to Open-File placement, be provided to the Colorado State Public Health Department when they first become available.

On-Site Radiological Safety Data*

All of the following data and samples will be collected by the Eberline Instrument Corporation (EIC) at the Rulison site on a daily basis. Direct data from samples will be derived by EIC at their Rulison site facilities. The subject data then will be mailed to the Open Files through the Nevada Operations Office. It is expected that these data will reach the Open Files about one week following collection. The extent of the sampling effort to be conducted will be contingent upon the rate of flaring, relevant meteorological conditions, and the results of previous sampling and monitoring.

1. *Stallkat Data*

   These digital data, along with applicable conversion factors and measured gas flow rates, will permit calculation of Tritium and Krypton quantities flowing out of the flare stack.

2. *Particulate Samples from Gas Stream*

   Derived data from these samples will permit identification of any particulate radionuclides.

3. *Gross Gamma Radioactivity in Flare Stack*

   Continuous recordings allow detection of gamma emitting nuclides in the gas stream.

4. *Water and Hydrocarbon Condensate Sampling*

   Sampling of water and other condensates from the gas stream separator will provide data on total radioactivity content prior to injection into the flare.

5. *Special Gas Samples from Flare Stack*

   Data from these samples will permit identification of gamma emitting nuclides whenever the gross gamma detector indicates their presence.

6. *Air Samples*

   The purpose of these daily samples is to permit detection of alpha, beta and gross gamma radiation in the air of the work area. Filters will be recounted five and twelve days after collection of samples to allow for decay of naturally occurring radionuclides.

7. *Thermoluminescent Dosimetry (TLD)*

   Data from TLD's will show 30-day cumula-

* As used herein, the term "on-site" refers to an area within a radius of approximately 1000 feet of the well.

tive exposure of on-site personnel to beta and gamma radiation.

8. *Vegetation and Soil Samples*

   This data will allow detection of radionuclides deposited in the soil and taken up by vegetation after 30 days accumulation.

Off-Site Radiological Safety Data

The Southwestern Radiological Health Laboratory (SWRHL) of the U. S. Public Health Service will collect off-site data and samples as set forth in the Radiological Safety (Public) section, pages 26 to 40, of NVO-61. As indicated in that section, and discussed below, the data and samples will be collected on a schedule determined by the nature of the monitoring and the state of actual operations. The monitoring and sample collection schedules given below are based on expected, normal operating conditions. If unusual conditions should be encountered, special procedures would be initiated for accelerated collection, analysis and dissemination of data.

1. *Air Samples*

   Fixed and mobile air sampling stations will be operated continuously during flow periods. Readings will be on a daily basis until data accumulated, as related to flaring operations, warrants less frequent readings. These air sample readings will yield data on radioactivity concentrations in the atmosphere and provide a basis for determining external radiation exposure to off-site population. This data should be in the Open File within a week of reading.

2. *Atmospheric Moisture Samples*

   In addition to the data described in 1 above (Air Samples), moisture samples will be collected from about five stations located predominantly in the downwind direction from the site. These samples will provide specific data on Tritium concentrations. The collection and processing of these data will be the same as for the air sample data.

3. *Water Samples from Battlement Creek*

   Samples of this potable water source will be taken for the detection of possible radionuclides. Sampling will be conducted on a daily basis until data accumulated, as related to flaring operations, warrants collection on a less frequent basis. Since the water samples will require a laboratory analysis for determination of radioactivity concentration, a longer period of time will be required for the resulting data to reach the Open Files. It is expected that this can be done within two weeks.

4. *Other Water Samples*

   The SWRHL water surveillance network, as described on pages 37 and 38 of NVO-61, will be activated during the post shot flaring operations. Samples from this network will be collected on a monthly basis during flaring. Due to the number of samples involved in this operation, the analysis will require several weeks. It is expected that the data from these samples should be in the Open-File System in about 30 days from the date of collection.

5. *Milk Sampling*

   Milk from local dairy and family-owned cattle will be sampled as discussed on pages 35-37 of NVO-61. These samples will be taken on a monthly basis and the data should reach the Open Files within 30 days from date of collection. In addition, samples will be taken from the SWRHL Standby Milk Surveillance stations in Colorado and other western states should conditions warrant this action.

6. *Vegetation and Soil Samples*

   Samples of vegetation and soil from locations around the Rulison site will be collected as described on page 38 of NVO-61. These samples will be collected on a monthly basis during flaring and the results of the laboratory analysis should reach the Open Files within 30 days from the date of collection.

7. *Thermoluminescent Dosimetry (TLD)*

   TLD stations will be established as set forth on page 35 of NVO-61. The instruments

will be collected on a monthly basis and results of the readings (which will be numerous and require laboratory techniques for measurements) should reach the Open Files within 30 days after collection.

Meteorological Data

The U. S. Air Resources Laboratory of the Environmental Science Services Administration, Las Vegas, Nevada, will collect and record the meteorological data required during the Rulison post-shot operations.

Surface wind directions and speeds as well as temperatures and relative humidity will be recorded continuously in the Rulison area. Upper wind conditions will be obtained daily by pilot balloon observations.

This weather information will aid in determining the dispersion of the flared gas and support the SWRHL activity of positioning radiation monitoring stations.

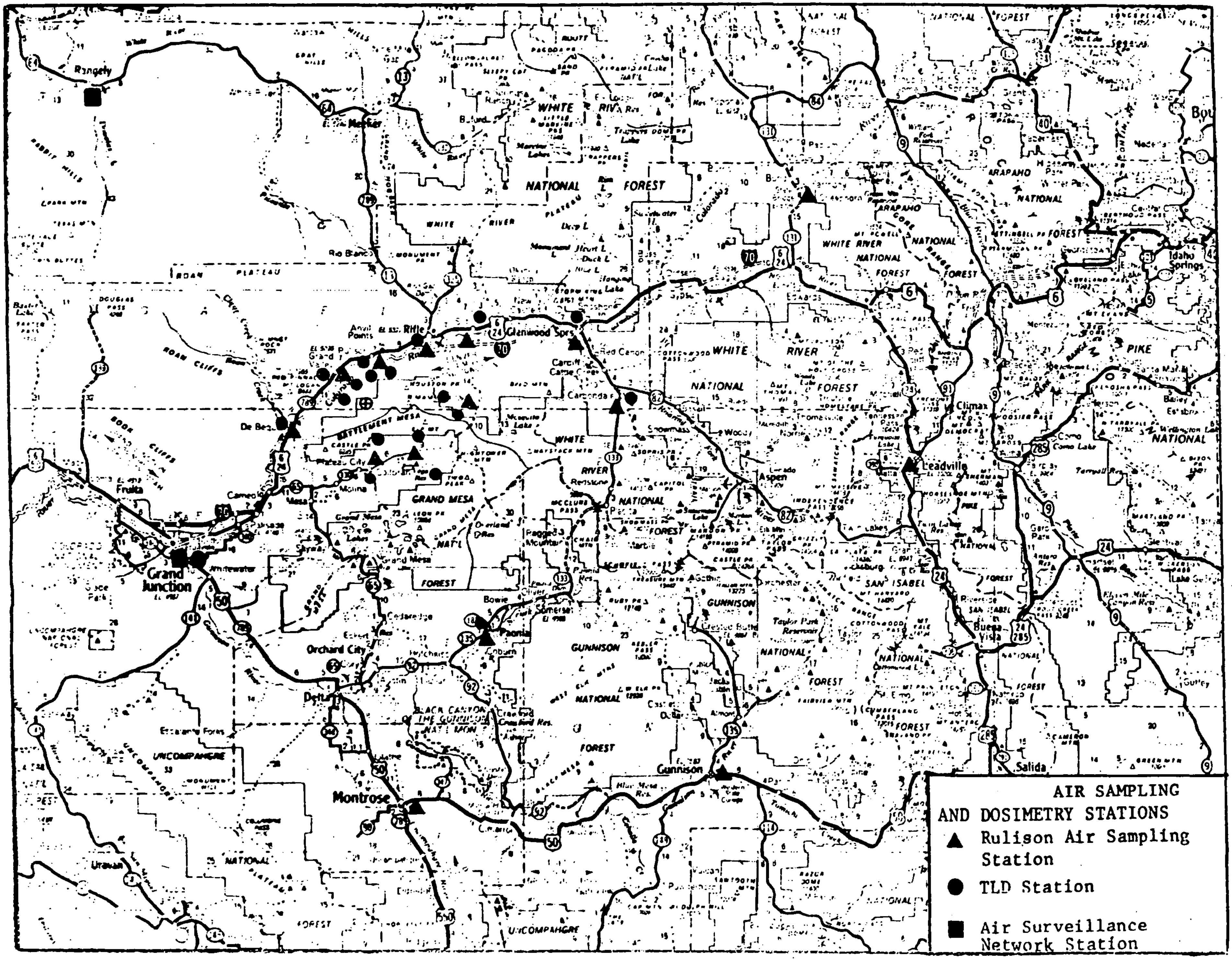
The above data will be sent to the Nevada Operations Office each day where it will be reproduced and mailed to the Open Files. It is expected that these data will reach the Open Files about one week following collection.

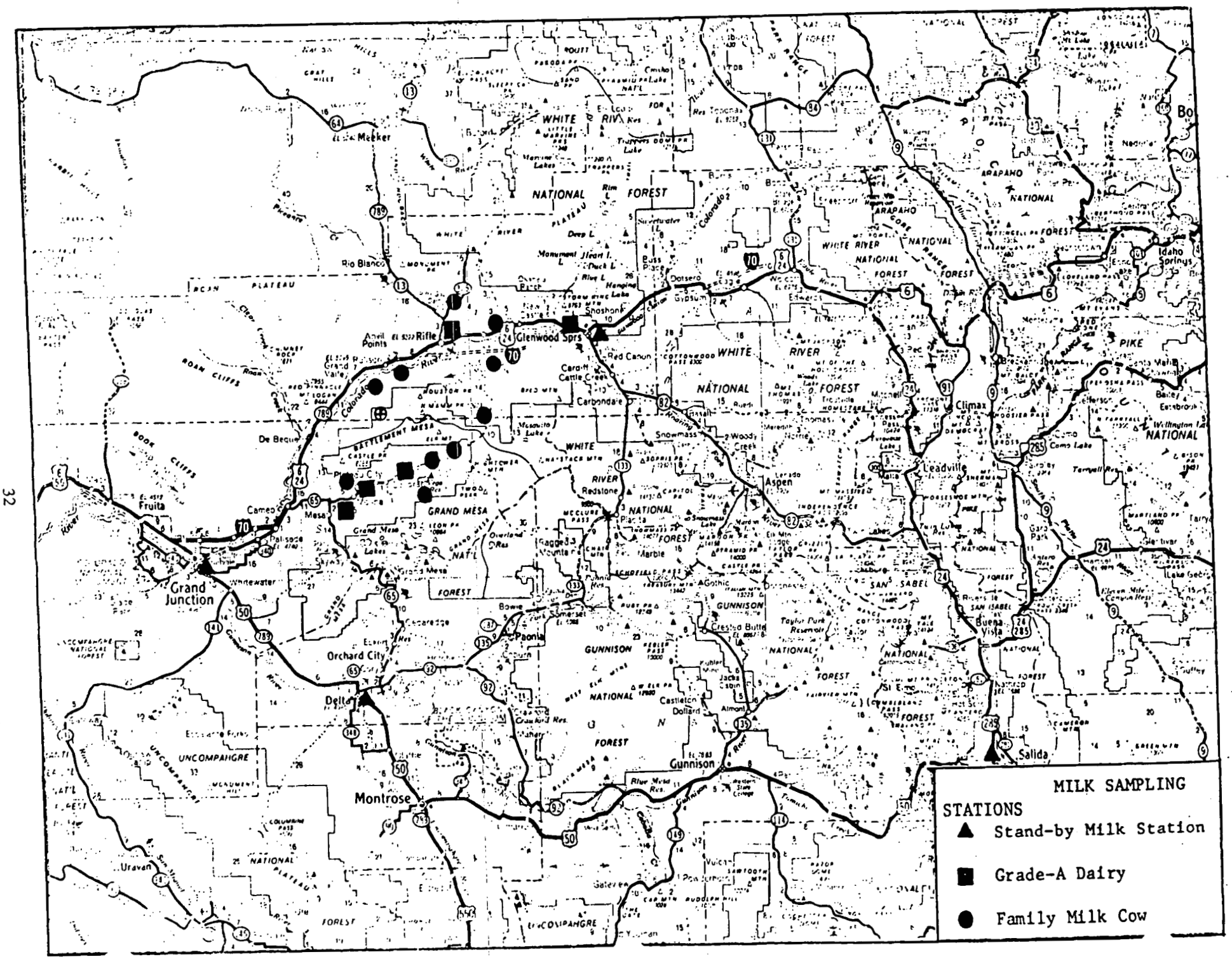
Chemical Analysis of Cavity Gas

Periodically, gas samples will be taken from the gas stream and sent to the AEC laboratories for detailed chemical analyses. These analyses will include the chemical composition of the gas, i.e., percentage of hydrogen, methane, ethane, etc., as well as the radioisotopic content of each of these constituents. Results of these analyses will be sent to the Open Files as they become available.

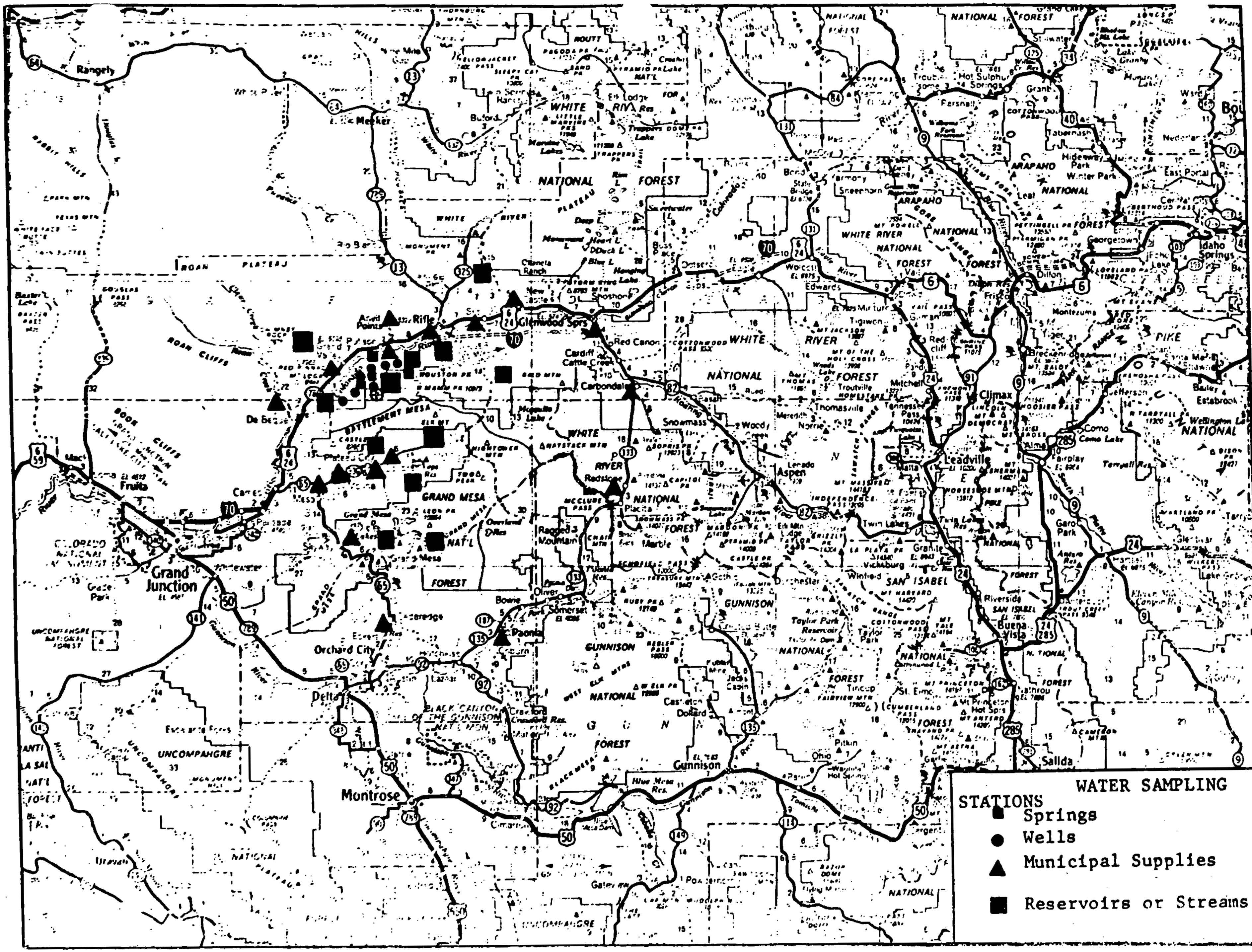
Public Announcements

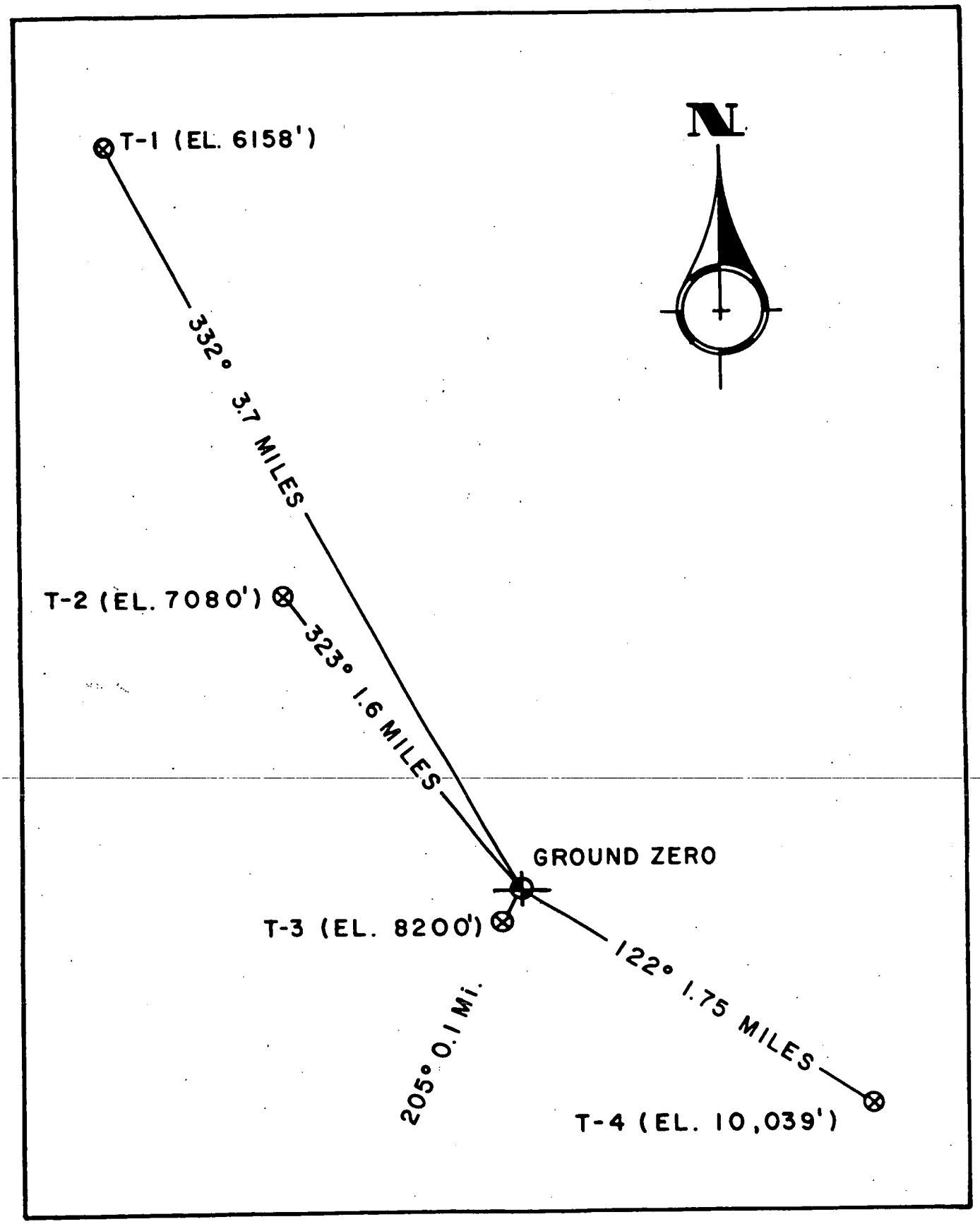
In addition to the specific data described above, the normal practice will be followed of issuing public announcements when certain key events occur, such as the beginning or completion of a major phase of the drilling and testing program. A special public announcement would also be issued if there were any occurrence which would affect the health and safety of on-site personnel or the residents in the area.


AIR SAMPLING
AND DOSIMETRY STATIONS
Rulison Air Sampling Station
TLD Station
Air Surveillance Network Station
Rangely
Meeker
Rifle
Glenwood Sprs
Grand Junction
Fruita
Delta
Montrose
Gunnison
Paonia
Leadville
Aspen
Salida
Climax
Idaho Springs
Orchard City
GRAND MESA
WHITE RIVER
NATIONAL FOREST
UNCOMPAHGRE
GUNNISON
SAN ISABEL
BLACK CANYON OF THE GUNNISON NAT'L MON.


MILK SAMPLING STATIONS
Stand-by Milk Station
Grade-A Dairy
Family Milk Cow
Grand Junction
Montrose
Delta
Orchard City
Paonia
Gunnison
Meeker
Rio Blanco
Rifle
Glenwood Spgs
Carbondale
Aspen
Snowmass
Redstone
Marble
Crested Butte
Castleton
Dollard
Almont
Buena Vista
Salida
Leadville
Climax
Idaho Springs
Fruita
Mesa
Palisade
Whitewater
Cedaredge
Somerset
Bowie
Uravan
Dotsero
Gypsum
Shoshone
Red Canon
Woody Creek
Taylor Park Reservoir
GRAND MESA
UNCOMPAHGRE
GUNNISON
WHITE RIVER
ARAPAHO
PIKE
SAN ISABEL
BOOK CLIFFS
ROAN CLIFFS
BATTLEMENT MESA
NATIONAL FOREST
NATIONAL PLATEAU

APPENDIX D


WATER SAMPLING
STATIONS
Springs
Wells
Municipal Supplies
Reservoirs or Streams
Rangely
Meeker
Rifle
Glenwood Sprs
Carbondale
Redstone
Aspen
Leadville
Climax
Georgetown
Idaho Springs
Fruita
Grand Junction
GRAND MESA
Orchard City
Paonia
Delta
Montrose
Gunnison
Buena Vista
Salida
WHITE RIVER
NATIONAL FOREST
GUNNISON
UNCOMPAHGRE



RULISON WIND TOWERS